Guide to Setting Up
Your Own Edible Rooftop Garden

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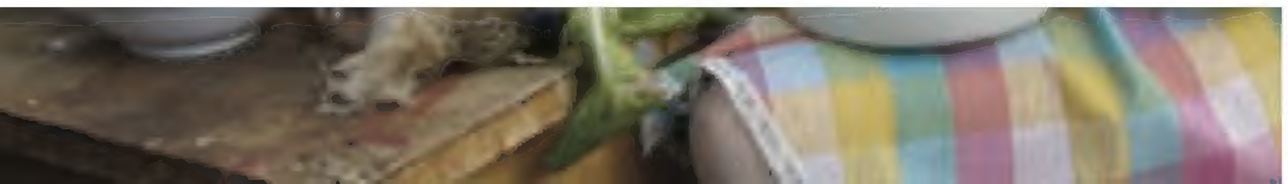

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Summer Team 2006

Standing, from left to right: Sanou Issiaka, Amélie Germain, Sam Makgoka, Alex Hill, Megan Thom and Rotem Ayalon.
In front, from left to right: Benjamin Grégoire, Ismaël Hautecoeur and Emmanuel Brunet.

PREFACE

After five seasons of gardening and experimenting, the *Rooftop Garden* project team is happy to share the fruits of its labor with you. The *Guide to Setting up Your Own Edible Rooftop Garden* comes from our wish to see new gardens and partners take root in the fertile soil of Montreal but also in other parts of the world.

By exploring new ways to interact with each other, with the built environment, the urban ecosystem and the food chain, we have discovered that change can happen in a manner that is participative, pleasant and inclusive. This observation comes from designing and participating in different rooftop gardens with the community. Each garden is a unique space that is maintained with care by volunteers from a meals-on-wheels program, meticulously cultivated by seniors, experimented on and brought to life by young urbanites or appropriated by families. Together, we strive for a better world, cities that breathe, a slower pace, sustainable management of resources and a more respectful and ecological way of life.

In our opinion, the renewed and infinite amazement that edible gardening brings is an excellent starting point on the path to that better world. The pleasure of discovering how the world that surrounds us works, how things like rain, wind, sun, the seasons, insects, migrations and new varieties of plants are interrelated brings us closer to the land, even from the extraordinary heights of rooftops. A greater understanding of urban ecosystems can only motivate us to cultivate diversity and appreciate complexity.

We hope that our humble acts of planting, upkeeping, harvesting, eating and sharing will bring as much pleasure to you as they have brought to our community of gardeners.

Ismaël Hautecoeur
Project Manager

The gardener's tool box, a garden in the making!

INTRODUCTION

Why garden on rooftops in the city?
Forgotten spaces rendered fertile for healthy communities

Gardening on rooftops in ever-increasingly dense and sprawling cities is an original way to take back unused and sterile spaces like rooftops, patios and balconies and to transform them into livable spaces that are lush, productive and purifying. In addition to embellishing the urban landscape with food-producing gardens at the tops of buildings and producing fresh food, these new spaces for the community enable us to reduce the ecological footprint of the houses and institutions of which we are an integral part. Recovering and decontaminating water, cultivating organic food, composting organic waste as well as filtering and cooling down air are all part of a mindset to make our established landscape more sustainable. Therefore, in the current context of environmental degradation, over-consumption and junk food culture, taking care of ourselves and our environment enables us to take a step down the path to healthy cities and communities.

Rooftop gardening means taking up an inspiring, ecological and productive activity, and developing new links with the food chain, the seasons, the environment and the community. This utopia's vision is to turn the city into a garden and its inhabitants into gardeners.

Why take up urban agriculture?
A simple source of joy and a socially engaged life style

The daily pleasures of gardening are simple, inexpensive and profoundly satisfying: eating a head of lettuce that was cultivated with care among friends, taking in the morning perfume of a flower clinging to the banister of a balcony, biting into a strawberry warmed by the sun. Urban agriculture is a veritable way of life and enables the population, collectively or individually, to take pleasure in new, green spaces that meet its needs for relaxation and leisure.

Far from a marginal expression or an anachronism doomed to disappear, urban agriculture is destined to play an ever greater role in feeding city dwellers. It currently feeds 700 million people, a fourth of the world's urban population (FAO, 2005). It provides an answer to food insecurity and an avenue for cultural expression and citizen involvement. It also enables people get a taste of the pure enchantment of growing food for themselves and for the community. In this time of climatic changes and the multiple, harmful consequences of urban living on health and the environment, we need to rethink the way we live. In light of this, urban gardening is a powerful agent for change.

Why did we create a guide?
A tool to encourage the spreading of rooftop vegetable gardens

The Rooftop Garden Project team presents this step-by-step guide to help you start and maintain your own edible rooftop garden both socially and horiculturally. This guide is for groups, individuals and institutions that would like to set up an urban rooftop garden for educational, social, therapeutic or environmental ends and do not have the ground space necessary to do so.

The guide is divided into six chapters that cover the main factors to consider when developing a rooftop garden project: project definition, choice of site, setting up the garden, coordination of gardening activity, health choices and a detailed technical guide on rooftop container gardening. Depending on your goals and your gardening experience, you may be more interested in and nourished by the first chapters than by the technical guide on container gardening and vice versa. In the annexes, you will find descriptions of our gardens and some additional information.

Our goal is to make planting these oases of edible nature in the city easier so that more and more people will start gardening on rooftops and discovering its benefits.

A smile says a lot about the sheer joy of picking the first broccoli of the season on the roof. A way of life to be cultivated!

1. DEFINING YOUR PROJET

The first thing to do when you want to start a garden is to develop and refine the idea behind the project. This is the step where we describe our intentions and expectations, choose the scope of the project, select the type of garden, target the garden's community and partners and evaluate the project according to accessible resources. The five steps suggested below may be carried out simultaneously. The reflection necessary for one step can often nourish or be nourished by other steps. Here's to the beginning of a beautiful project.

Where should we start in order to launch our garden project?

1.1 Describe the Roles and Goals of the Garden

You should make an outline of your garden here. Think about its goals and what factors motivate the project. There are many possibilities. For example, you can create a garden with aims that are:

- **social and community-based**: Gardening favors contacts and exchanges and betters the quality of life. For seniors, gardens stimulate social encounters, physical activity. It can mean getting back to the earth for some and participating in a lively project that comes with various therapeutic benefits. The community in contact with the garden will benefit from the feeling that comes from helping others, commitment to a project and socializing with one another;
- **educational**: As a place for experimentation with nature, the garden can be a space for pedagogical and recreational activities that will reinforce scholastic materials or themes from day camps (ecology, botany, health, alimentation, cooking, gardening, biology, etc.) and increase the spirit of initiative, teamwork, patience, etc.;
- **based on food security**: Gardening will favor the production of food for a meals-on- wheels program or a food bank, or for personal use;
- **economic** : A rooftop garden can improve a building's energy efficiency and increase its value for little cost by expanding the useable space. Food cultivation also diminishes expenses related to acquiring food;

- **environmental**: Here, we are referring of the improvement of air quality through the absorption of carbon dioxide and the production of oxygen by plants. The consequent increase in humidity and evaporation will bring down the ambient temperature, biodiversity will attract birds and insects; and plants will absorb ambient noise. Using rainwater to irrigate plants will reduce pressure on the municipal waterworks and can be integrated in a system that uses household wastewater. Eating organic and local will reduce the quantity of chemical products used to grow plants and to transport food;
- **horticultural**: Experimenting with new gardening techniques or developing a new model for urban gardening to spread urban agriculture could be on the menu;
- **personal**: Te simple pleasure of gardening and being able to benefit from a relaxing space at home will be the foremost motivation.

> I am involved in the garden to meet people that have interesting social values. I find that it is also a zen activity that does not require you to be productive as in most types of work.
>
> *Volunteer, age 41*

Groups should clearly mark out their project goals when planning begins to ensure that all the concerned participants have the same expectations. Plan discussion sessions. They will enable you to work efficiently at building the project. It is also recommended that you involve the team that will use and look after the garden as early as possible to get their ideas, know their needs and stimulate their interest!

1.2 Define the scale and document the project site

Determining the project scale to be developed is important: a temporary project, a project that will evolve over a few years or a project that will put in place permanently.

This decision may be influenced by available resources (*see section 1.5*). Your site choice may also influence the scale of the project, or it could be influenced by the scale if a decision has not been made yet (*see Chapter 2*).

To help you document your site, examine the envisioned project's real conditions:

- site characteristics (geographical situation, clientele, type of neighborhood, hardiness zone, etc.);
- description of the targeted building: height, access, barriers, type of roofing, etc.; and of neighboring buildings: adjoining areas, facade, back, alleys, streets, traffic, etc.;
- implications and consequences of implementing the project in the neighborhood.

1.3 Select the type of garden

Rooftop gardens may be designed in various ways. The most well-known are green or vegetated roofs as well as balcony gardening in containers. Green roofs, whether intensive or extensive (accessible or not), are covered with soil in which plants take root. Container gardens refer to ornamental and edible plants grown in containers. The costs, ecological advantages and versatility of crops differ according to each type of organization (*see Annex C*).

As this guide is based on our expertise, it deals mainly with gardens cultivated in containers. If you are interested in green roofs, we suggest you get in touch with professionals in green roof construction (*see references*).

1.4 Make a List of People Involved in the Project

a. Pick the team of gardeners (and the beneficiaries)

Who will the project managers and participants be?

To start the project correctly, form a design team (resource people) that will, if possible, bring together architects, landscape architects, structural engineers, construction professionals, roofing professionals, communicators, etc.

Define who will do the gardening: volunteers, beneficiaries, residents, a group of friends, neighbors, an organization, etc. You must know the size of group as it will influence needs and garden organization.

Within the group, you should clearly determine who will tend the garden and who will receive the harvests. These groups might be the same, or they could be two different groups. You must also know the people who will take care of the garden well. Are they specialists, amateurs or beginners in gardening? This will influence how you coordinate gardening activity. (*see chapter 4*).

b. Determine who your partners are

Who should we contact?

When you define the project, be sure to talk with the various partners (site owner, management, community, benefactors, unions, employees, etc.). When you have to negotiate with a group, prepare good arguments ahead of time in order to sell the project. Be convinced and convincing; the potential partner must quickly understand the advantages to investing in such a project. When possible, find an ally within the group you are negotiating with to get support.

The step can be laborious. Therefore, be prepared, patient and persistent.

1.5 Evaluate the Project according to Accessible Resources

You should take inventory of your human, financial and material resources. To accomplish this task, create a calendar of required resources for the different project phases: setting up, beginning of activities, period of use, end of activities, winter clean up. Think of what is needed to get the project on its feet and to set up and take care of the garden in terms of space, volunteer labor, outside expertise, gardening equipment and material for cultivation, for fixtures, for financial sources, etc.

Next, sort materials in order to make a list of resources in your possession and resources you have to find. You can then decide, according to the

group's energy, what missing resources can be found easily (recovery, recycling, volunteer time, rentals, fundraising, etc.).

Once inventory is finished, you may feel the need to upscale or downscale the goals and size of the project. The goal is to launch a realistic project that matches accessible resources. This will avoid disappointments along the way.

I simply love being on the rooftop, gardening and learning new things about gardening.

Volunteer, age 10.

Discover the great surprises hiding in the soil!
An extraordinary way to get in touch with nature in the city.

2. CHOOSING THE SITE

Once the project has been well defined, you can choose the site. Several factors should be considered. The possible site or sites must be evaluated to verify safety levels and to make sure gardening activities could be functional and pleasant in the area. Keep your eyes open!

What factors should be examined when choosing a site?

2.1 Loading Capacity

The first step is to evaluate the roof's loading capacity, the load that the roof can support. This is important as the weight of crops, equipment and people that the garden will take on must be considered.

To undertake this structural analysis, you must call on a structural engineer. You should inform the engineer of the type (container or green roof) and surface area of the garden you would like to create. This will greatly influence the structural needs.

The engineer can:

- determine the type of roof (flat or having different levels) and the framework used;
- determine the type of construction (wood, steel, concrete);
- evaluate the possibility of carrying out the project;
- determine the influence of obstacles and the possibility of getting rid of or moving them (vents, chimneys, vent ducts, etc.);
- study existing plans or make a survey sketch and map out the current conditions;
- verify the real load capacity according to the survey sketch or plans provided.

After studying the situation, the engineer can either mark out certain parts of the roof where the garden can be set up or propose a framework for reinforcement. The latter solution will undoubtedly mean costs that may lead you to turn to another site. Therefore, proceeding with a structural analysis at the very beginning of the project is recommended.

2.2 Municipal Regulations

Before starting construction of a rooftop garden, you must get information on regulations from your city. Regulations vary from city to city and sometimes from borough to borough.

In addition to building codes that regulate materials and ensure conformity to the building code norms, you must also check the zoning regulations for setbacks, use of space and maximum height of the building. Certain buildings may also be classified as historical monuments or as being part of a historical sector, which also limits some types of possible actions.

Get information concerning railing, access and security limits. These are important points you should pay attention. Very often, railing must not be visible from the street at a distance equivalent to two times the height from the edge. Height from the edge is also regulated. Access is often regulated by fire codes (emergency exits). You should make sure regulations do not require two exits for this particular project, in which case you may need to add a staircase. There may also be restrictions on flammable materials and on the height of structures like pergolas and pavilions.

In certain cases, you may be able to request an exemption from local authorities that would allow you to carry out the project even if it is not exactly up to municipal codes. This will, however, add extra delays and costs, and there is no guarantee you will obtain the exemption.

Architects and architectural technicians are professionals who are qualified to do this research and verify project conformity to norms and regulations in force.

2.3 Sunlight and Wind Exposure

Sunlight

Light is a fundamental need for plants. A study on the hours of sunlight on the roof must be carried out. As roofs are elevated, they generally offer sunlight conditions superior to most urban areas on the ground. Food cultivation necessitates long hours of daily sunlight, meaning ten hours a day for the most heliophilous plants (e.g. tomatoes).

Depending on the chosen plants and features you would like to incorporate in your garden (reading corner, composting area, etc. – see section 3.2), you should plan the garden in the area(s) (full sun, part shade) that correspond to your needs.

If you observe a quantity of sunlight that is too great for the plants you would like to grow, you can decrease it by creating structures that produce lighter or darker shade: a shade wall, an arbor, a trellis, a row of tall plants, etc.

Wind

Wind is often stronger at rooftop heights than at ground level. A light breeze is very pleasant for gardeners, but strong winds could seriously damage plants. Creating a wind breaker (vegetal walls, structures, canvases, etc.) is recommended if there are strong winds or gusts of wind.

If the structure must be attached to the roof, you should make sure the parts of the frame are resistant. The structure must be sturdy but must not change the roof's water resistance or framework.

2.4 Access and Security

Several elements related to gardener's access and safety must be analyzed before choosing the site.

Access

Practical Access and Roof Safety

There should be an official access to the roof (stairway, elevator) to make the garden accessible to everyone. This access should be functional for transporting material to the garden.

Access to Water for Plants

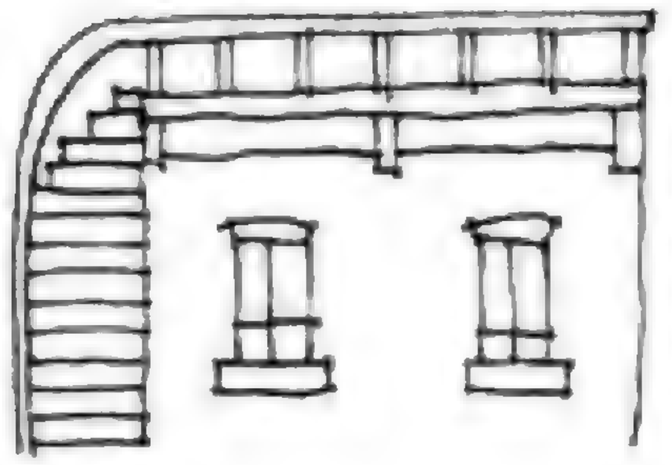
Like sun, water is a fundamental need for plants. As rain does not always come on time, an access to municipal water is essential. You can also install a rainwater collection system by rerouting a gutter to a reservoir, for example. This solution will create a heavy load of water on the roof at random times, and the structural engineer should check the loading capacity in the designated place.

Access to Electricity

An electrical source is very practical for construction work and development or for the simple pleasure of listening to music in the garden.

Access to a Storage Area

Plan an access to an area sheltered from inclement weather to store equipment, material and gardening tools.



A good start means having a structure that is up to norms, a space that is safe and functional and plenty of water and sun.

Safety

Peripheral Surveillance

Informal (neighboring windows, passersby) or official (security guards, security cameras) surveillance will ensure the safety of gardeners and help avoid incidents in the garden (e.g. vandalism).

Installation of an Enclosure or a Banister

An enclosure or a banister should be 42 inches (1067 mm) tall and encircle the space designated as a garden. These protections must conform to regulations as mentioned in section 2.2

2.5 Specific Needs

If the garden's clientele has specific needs, you must account for them from the beginning. Easy access will be an important issue if the garden is destined for elderly people or people with handicaps. Installing shady areas is recommended if seniors or young children use the garden.

2.6 Other Options

Note that if you plan a garden somewhere other than a roof, such as a terrace or a balcony, you must consider the same factors but on a smaller scale.

Don't forget to plant perennials in your garden!
They'll attract helpful insects.

3. DESIGNING THE GARDEN

Once the project has been defined and the site has been chosen, you can think about how to set up your garden. This step calls for the most imagination and creativity because your garden will take form at this time. Get out your pens and paper!

Two possible choices

a. Hire a design professional who is part of an association or an order, such as :

- L'Association des architectes paysagistes du Québec (AAPQ), **www.aapq.org;**
- L'Association des paysagistes professionnels du Québec (APPQ), **www.appq.org;**
- L'Ordre des architectes du Québec (OAQ), **www.oaq.com;**
- L'Ordre des technologues professionnels du Québec (OTPQ), **www.otpq.qc.ca**

Using the engineer's plans and estimate, a professional, such as a landscape architect, can:

- create an aesthetic and functional development plan based on the possibilities and constraints of the site, according to your tastes, your needs, and your budget;
- advise you on the choices of flowering and food producing plants;
- draw up plans and a labor estimate;
- supervise work that will be carried out by the professional of your choice.

b. Do it Yourself

If you would like to do this step yourself, here are some notions to guide you in creating your garden.

How do I design and construct a garden on my own?

3.1 Prepare the Rooftop for Setting up the Garden

If necessary, make a building plan (plans and general estimates) to prepare the rooftop for the garden and for gardening activities and to make certain it fits your budget. As this step must conform to certain building and safety norms, we suggest you call on professionals (see step 2).

The plan must be designed in direct relation to the framing plan. The distribution of weight should be approved by the structural engineer, who can, if needed, identify structural modifications to be made. The framing plan is often completed by a short estimate that shows construction to be carried out, materials to be used and norms to be respected.

As a general rule, heavy loads must be located near columns and beams located on the existing roof plans as they were drawn by the engineer.

Once the plans have been drawn up (terrace site, access, construction details, location of equipment to be used, etc.) and approved by the structural engineer or completed using separate plans by the engineer, you must obtain a building permit from the city.

Get information from your insurance company about changes to be made to your home insurance.

Ideally, this step should be done simultaneously with step 3.2. Each phase will give you food for thought on the other.

3.2 Imagine and Draw the Garden

a. Site Analysis Plan

On paper or using drafting software, place the basic features as well as possibilities for and constraints of the site: sun areas (full sun, partial sun, shade), access to water and electricity, interior and exterior access, circulation areas, railing, special features related to safety, etc.

Step 2 will be useful for creating the site analysis plan.

b. Garden Uses

Make up a list of utilitarian and recreational uses that you would like to have in your garden: food production, relaxation and contemplation, gatherings, storage, rainwater recovery, area for doing manual labor, composting, etc.

You can also use general concepts (permaculture, ecosystems, educational garden) as inspiration or create thematic spaces (herbs, medicinal plants, children, horticultural experiments, First Nations, production, etc.).

c. Conceptual Plan

On the analysis plan, place different uses and thematic spaces you have chosen for the garden by drawing and annotating areas or bubbles.

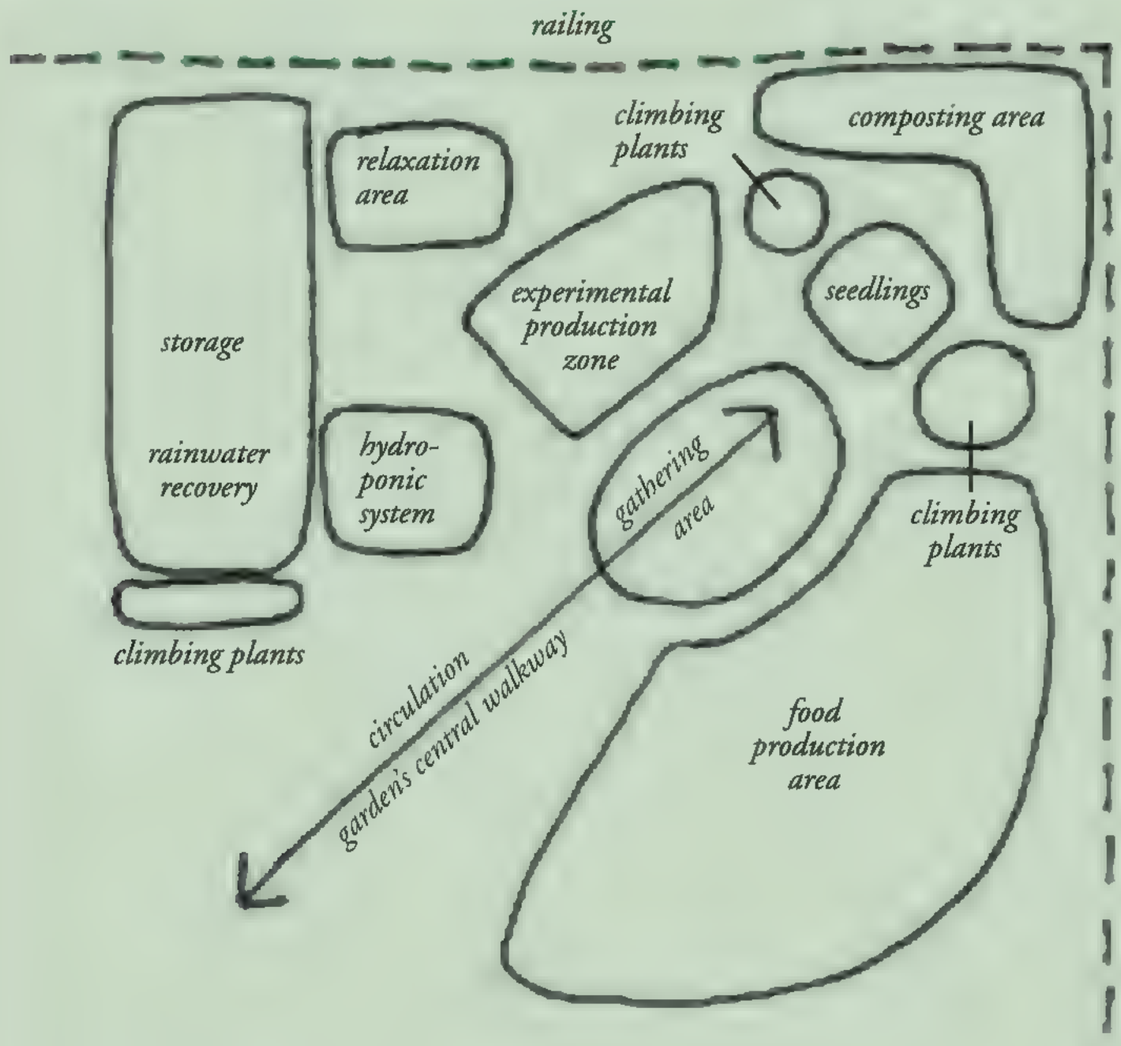
Determine the size of areas according to your needs and priorities.

Make sure that the finished product is functional and, or course, inspiring.

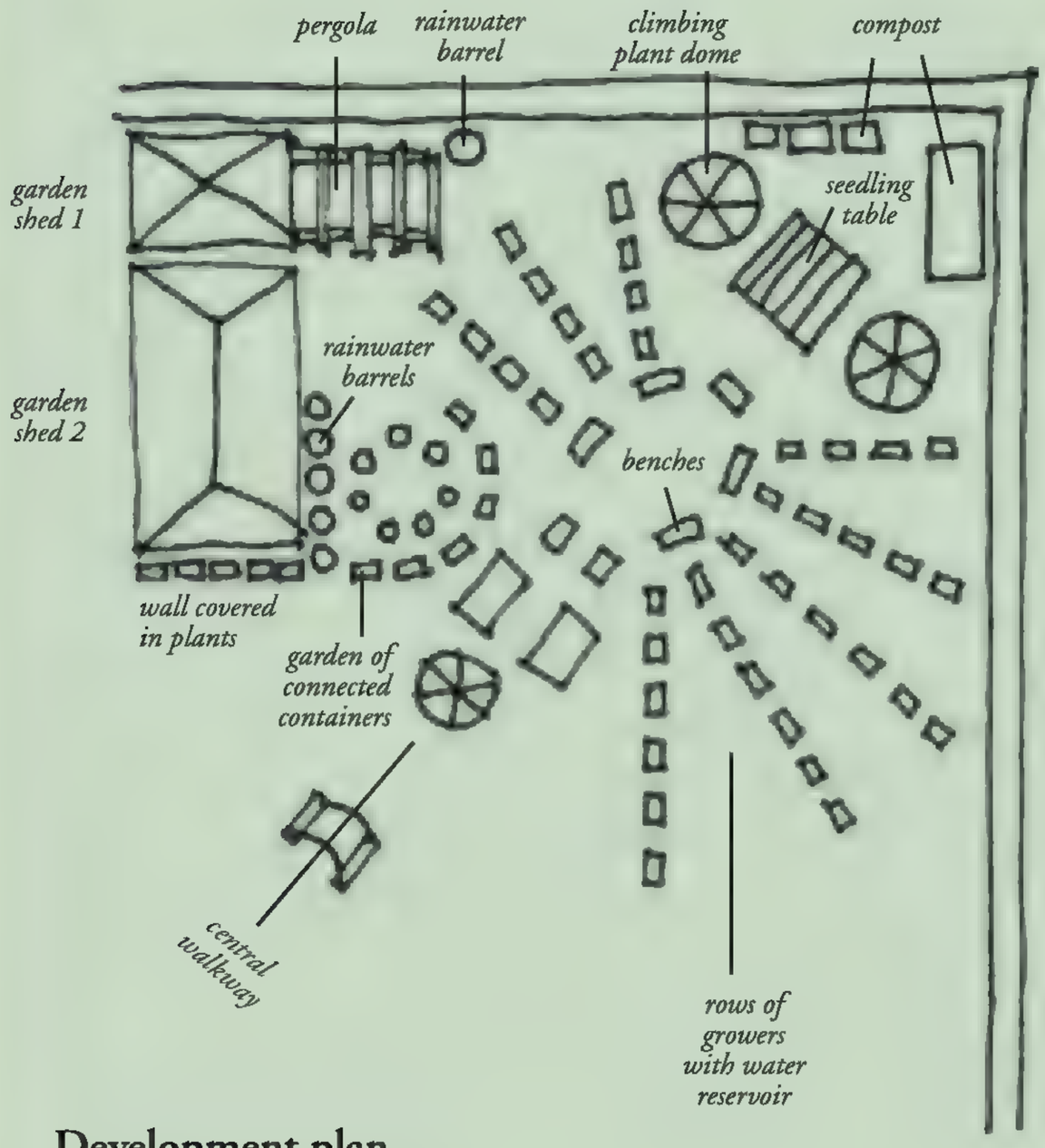
d. Development Plan

You now have everything you need to give shape to your garden. On a new drawing, copy the conceptual plan and draw the real shape and location of different spaces (production, relaxation and storage areas; butterfly garden, etc.) and features (benches, compost bin, pergola, etc.) in detail.

Conceptual Plan and Design Plan



Conceptual plan



Development plan

Be creative! Think about the unity and balance of the garden, about how to highlight features, about lines and forms, about textures and colors. You can create an overall theme or personalized spaces.

Work to scale. The most common scales are: ¼ in. = 1 ft. or 1:50 in metric values. You can use grid paper when you are doing the rough sketches to make the task easier.

Leave sufficient space around garden beds or containers to make gardening easier.

Take the location of a drain on the roof into account. It should be accessible at all times to drain water from the surface. Water must not be obstructed from reaching the drain.

Make several drawings while brainstorming. Don't hesitate to work in groups. Choose the most stimulating and most functional plan afterward. Keep in mind that you can always change the design as things progress if necessary.

There is a wide selection of books on landscaping and garden design. Visit your library or a local bookstore for inspiration.

Avoid overdoing it

Your garden can be developed in different steps, spread out over several months or years. Be careful not to overestimate your time and energy. Keep in mind that gardening should be a source of enjoyment!

Engineer's Verification

If the project calls for changes to the structure or significant additions during construction, having the structural engineer check the completed construction is recommended to get his or her final approval.

This is particularly important if you install a pergola, a shade structure or a wind breaker on a high roof because strong winds could blow the panels off making the installation dangerous.

3.3 Build the Infrastructure and Lay Out the Garden

a. Building the core infrastructure

Start construction using plans approved by your city. If major work on the access, the terrace or the railing is to be done, we recommend you hire a building professional (a general contractor that will take care of all the construction). It is always preferable to request bids from three contractors to ensure you get a fair market price.

If you do not have a contractor, look for a person with experience in construction or someone who is handy that can supervise and coordinate volunteers' work.

Sometimes it is very practical to establish a construction schedule so that combined efforts converge on an opening date for the garden. Look out for late work, delays, bad surprises, extra costs and other unexpected problems.

The infrastructure could be made of modular, detachable parts to allow access to the rooftop at all times in case there is a leak or maintenance must be done. You will find an example of such parts in Annex D.

To optimize use of materials and reduce costs, use recycled or reused materials as often as possible. For better longevity, use treated wood.

b. Build Garden Features

Using the development plan, start construction on structural features like a pergola, an arbor, benches, etc., as well as functional features like compost bins and rainwater barrels. You can create them using technical designs you have drawn or found in construction manuals. You can also let your imagination take over when the task is at hand. Several features can be bought.

c. Construct Growers

Decide what type of grower is suited to your needs. Here are some criteria to consider:

- dimensions (height, width, depth)
- shape
- productivity (depth of growing mix according to plant choice, water reservoir, dimensions, etc.)
- durability and maintenance of material
- mobility (weight, wheels)
- aesthetics (color, style, material)

Build the number of growers needed according to your feeding needs and the available space.

See chapter six for models and for construction plans.

d. Put the Various Features into Place

With your development plan in hand, put the features into place and watch your garden grow! It is sometimes useful to trace the lines of the drawing on the ground to transpose your plan onto the area. Strings or chalk are particularly efficient.

4. COORDINATING THE GARDEN

How do I coordinate a group of gardeners?

There are several different ways to garden in the city. You can choose to garden by yourself at home or with a group. Group gardening involves special coordination and offers rich opportunities. Here are some ideas that will guide you in this task.

If you would like a concrete example, see *The Roulant Garden Experience* in Annex B.

4.1 Find out about Group Gardening Models in Montreal

Here are some gardening and leadership models that might help you cultivate techniques for managing a group in the garden.

> I told myself that gardening might be an activity to do with my 10 year-old daughter. I wasn't looking for anything in particular, but gardening is a fun activity that she might like and that is related to social engagement and ecology. The Rooftop Garden Project brought together recreational activity and social engagement.
>
> *Volunteer, age 52*

A few ideas…

a. Two Basic Models

Community Gardening

A community space is divided into gardening plots of equal size that are managed individually by a gardener or by a family. Maintaining the plot and harvesting are the gardener's responsibility. The gardener works during varied hours. Activities are subject to regulations and overseen by a committee.

- *Pros*: autonomy of gardeners, flexible hours, material provided, possibility of keeping the plot for several years.
- *Cons*: rigid framework of regulations, restricted choice of vegetables, little technical aid, difficult to personalize the space, waiting lists, high maintenance.

Reference :
Community Gardens of the City of Montreal, **www.ville.montreal.qc.ca**

Collective Gardening

A group of people garden together during regular gardening sessions. Harvests are divided in an equitable way and according to gardeners' needs. In many cases, part of the harvest is distributed to a local organization (meals-on-wheels, soup kitchens, food banks). A specialized leader sometimes coordinates gardening sessions.

- *Pros*: creates links in the community, a feeling of solidarity, shared upkeep, strong feeling of belonging.

- *Cons*: fixed times, little continuity, rarity of available spaces, complex procedure to start new gardens.

References :
Jardins collectifs de la maison de quartier Villeray, **www.mqv.qc.ca**
Action communiterre, **www.actioncommuniterre.qc.ca**

b. Leadership Possibilities in the Garden

With social and environmental aims, leadership in the garden enables horticultural knowledge to be passed on and energy to be injected in the group through social and recreational activities.

Leadership activities can have different goals and target different groups: therapeutic gardening for elderly people in institutions, educational gardening for young people in day camps and schools, a production garden and socialization for a community, etc. Local, specialized organizations can offer different group workshops.

For more information on models, see our project examples in Annex A.

4.2. Launch and Recruit

Once your project has been defined and your site has been chosen, you can organize your first gardening season and mobilize the community. Here are two steps that will help you get the season started off on the right foot!

a. Form an Organizational Committee

Create a small group that will take responsibility for the garden launch or opening/inauguration and coordinating the gardening season: recruitment, coordination of group meetings, respect for rules, conflict management, calendar, etc.

b. Spread the Word and Mobilize

Spread word about the garden project in the targeted community: informational meetings, message boards, posters, emails in a network, advertisements or articles in a local newspaper, door-to-door visits, telephone calls. Offer flexibility in terms of involvement. Make a list of people who are interested; then, organize the meetings to plan:

- the choice of times for gardening sessions:
  you should consider the regular needs of plants, the constraints of mid-day heat for plants and gardeners, availability of clients;
- the garden launch, designing the garden (*see step 3*), the choice of plants and fertilizers;
- how group work will function;
- the management of harvest division;
- horticultural workshops and activities;
- and much more.

4.3 Ensure Good Communication throughout the Season

You will quickly notice that sustained and varied communication is essential to maintain the energy and health of the garden community.

- Determine the best way(s) to communicate within the group (message board, email, regular meetings, log, Internet site, etc.).
- Update information concerning the garden frequently (upcoming events, times, rules, contact lists).
- Avoid sources of conflict by being clear on rules and by opening a space for dialogue.
- Encourage social activities that favor group cohesion (*see section 4.5*).

This project creates a space in my life where I let myself "play outside in the sun" while giving my time to something bigger –helping one another within a community.

Volunteer, age25

4.4 Ensure Horticultural Follow-up

As the garden is a place to produce food, it is important to succeed in producing harvests that satisfy everyone. Here are ideas to help you:

- encourage the sharing and transferring of horticultural knowledge in the group (in an informal way and/or through workshops) in order to obtain a harvest that is worthwhile for everyone and to avoid errors, conflicts and disappointment. When necessary, ask for help from expert organizations or hire an organizer.
- maintain an up-to-date horticultural log that informs gardeners of the health and development of the garden: care given to plants, observations, harvests and things to do (watering, fertilizing, harvesting, pruning, treating, inspecting, etc.)
- prepare an annual calendar of tasks linked to the garden (from starting seedlings to closing the garden) so as not to forget steps and not to cause delays in the season.

4.5 Multiply Garden Activities

In addition to providing a space for flora and fauna to live, the garden is also a social space. It can be a place for:

- contemplation and observation of nature in the city
- recreational and artistic activities (mediation, creative workshops, outdoor cooking, making art objects, bird houses, kites, soaps, etc.)
- meetings and events (discussion and spreading information on urban gardening, film projections, harvest parties, BBQs and family picnics)
- education and therapy, the garden is a privileged area for building awareness to nature, to food and to healthy life styles and also for discovering the physical and psychological benefits of gardening.

Gardens open new spaces for the community. They are spaces for everyone to enjoy!

Playing in the garden, something that is enjoyable every time!

5. MAKING HEALTHY CHOICES

How to grow in order to eat well

A healthy diet coupled with the exercise of gardening is an excellent start for good health. For even more benefits, you should take several agricultural ideas into consideration to maximize the nutritional benefits (for the body and the spirit) that you will take from your harvests. Take time to think about all aspects of your garden, from buying your seeds and designing your garden at the beginning of the season, to fertilizing, treating diseases or controlling pests throughout the season.

5.1 Gardening Ecologically

If you are worried about the quality of the food you are growing, you can optimize nutritional value by gardening in an ecological way. To do so, you have to avoid using chemical fertilizers, pesticides and herbicides when taking care of the various problems in your garden. Instead, think of solutions that are in harmony with nature (e.g. compost for fertilizer, companion planting to maximize yield and natural pesticides, or purins, made from fermented plants to keep harmful insects away). This is better for your health and for that of the environment. You can also get certified organic seeds. Don't forget that in gardening for yourself, you have the privilege of controlling the quality of what you eat.

Tomatoes are an excellent source of vitamins A and C, potassium and fiber.

Green vegetables like spinach are a good source of vitamins A and E, folic acid, calcium, copper and iron.

5.2 Diversifying Edible Plants

Diversification of plants in the garden is a guarantee for success in a healthy and varied diet. In fact, it will enable you to have access to a higher number of nutritional elements as each food has different characteristics. You will, therefore, have easy access to vitamins, fibers and minerals.

The variety in your garden will certainly lead you to eat more fruits and vegetables and will increase your interest in them. This keeps with recommendations from the *Canada Food Guide*, which suggests five to 20 portions of fruits and vegetables a day.

If you are looking for particular benefits for your health or if you have a special diet, gardening for yourself is a good occasion to focus on foods that are good for you.

Diversification of crops and of the foods you eat will also contribute to reducing certain risks for diseases and to maintaining ecological biodiversity.

5.3 Putting Medicinal Plants in the Garden

In addition to fruits and vegetables, think of putting medicinal plants in your garden. For centuries, knowledge about the medicinal virtues of plants and how to prepare them has been cultivated. Your grandmothers probably have a few recipes! The therapeutic effects of plants are numerous and should be rediscovered so that current generations can benefit from them. There is a wide range of books that you can find in stores or at the local library that discuss the benefits of plants and of growing them.

This is also a way of bringing indigenous species from our region and other forgotten wild species into the garden. Several fine herbs also have incredible virtues. Inform yourself.

5.4 Understanding Risks Associated with Urban Pollution

Several risks related to soil, air and water pollution raise questions about the quality of food cultivated in the city. Though there are currently few studies on this subject, container gardening makes an interesting alternative to avoid certain risks of contamination. In fact, it will enable you to minimize the possible negative consequences because its versatility offers greater leeway in terms of the medium for agriculture, site selection and choices in water sources.

a. Soil Pollution

Urbanization and the changing use of soils in the city have led us to build upon ground that has already been used for industrial activity and has never been decontaminated. The concentration of heavy metals, a major contaminant, above all in places where the population is in direct and prolonged con-

A Healthy Recipe!

Succulent Ratatouille from the garden:
A Recipe from Santropol Roulant

A side dish frequently prepared by the meals-on-wheels program at Santropol Roulant (see *The Roulant Garden Experience* in Annex B). Serves 4.

Ingredients

- 2 eggplants
- 4 tomatoes
- 2 zucchinis
- 2 onions
- 1 sprig of thyme
- Salt and pepper to taste
- Oil

Preparation

1. Clean the eggplants, tomatoes and zucchinis. Cut them into small pieces.
2. Peel the onions and cut them into small pieces.
3. Clean and chop the thyme.
4. Cook the onions on medium heat for 5 minutes.
5. Add the other vegetables and cook them for about 1½ hours on low heat.
6. Season with salt, pepper and thyme.

Enjoy!

tact with contaminants (residences, parks, schools, yards and playgrounds), is a considerable risk for human health. Eating vegetables grown in contaminated soils could cause health problems because the plants generally absorb heavy metals in their edible tissues (Chaney, Sterrett et Mielke, 1984).

While waiting for the desired decontamination of our soils, container gardening shows itself to be an effective solution to get around this problem. The gardener can also control the elements that make their way into the grower. You can, therefore, avoid letting heavy metals make their way into your food.

b. Air Pollution

The location of your garden can have an impact on the quality of the fruits and vegetables that are produced. Gardens found near congested thorough-fares or train tracks may be contaminated by air pollutants that come from combustion. However, this risk has been greatly reduced since lead was removed from fuels.

If you are doubtful of air quality in the area where you garden, it is always better to wash fruits and leaves with soap or a water and vinegar mixture to remove most of the particles that are deposited on plants (Chaney, Sterrett et Mielke, 1984; Armar-Klemesu, 1999).

c. Water Pollution

Clean water should be used to irrigate plants. If you can collect water on your roof, rainwater is the best source of water for watering plants; it reduces the pressure exerted on the municipal water network. The temperature of rainwater is naturally warm and will not shock the plants, contrary to cold water from the waterworks system. In addition, this water does not contain chlorine, which inhibits plant growth.

If you choose to collect rainwater to irrigate your garden, make sure that you store it properly, i.e. in an opaque container with a mosquito net to avoid algae and mosquitoes. For more information, see section 6.5, *Collecting Rainwater.*

Chamomile flowers (above) can be used for treating stomachaches and insomnia in children as well as for calming nerves. The tea also has anti-inflammatory properties that work against rheumatism and arthritis and antispasmodic properties that calm menstrual and intestinal pain. It also acts as a mild laxative. A lightly steeped tea will combat cold symptoms, the flu, and allergies. As a compress, it will calm skin inflammations, burns and sunburns. Added to the bath, it has relaxing properties.

Mint tea is known to help digestive problems, but also to combat fever, bronchitis, the flu, headaches, morning sickness, stomach pain and other minor pains.

Sage tea makes an excellent antiseptic for treating mouth sores and sore throats when used as a mouth wash. Used as a compress, it soothes cuts and wounds.

Sources :

Armar-Klemesu, Margaret. *Urban Agriculture and Food Security, Nutrition and Health,* Growing Cities Growing Food International Workshop, Havana, Cuba, thematic paper n° 4, 1999.

Chaney, Rufus L., Susan B. Sterrett and Howard W. Mielke. *The Potential for Heavy Metal Exposure from Urban Gardens and Soils.* In. J.R. Preer (ed.) Proc. Symp. Heavy Metals in Urban Gardens. Univ. Dist. Columbia Extension Service, Washington, DC, 1984.

Take out your tools! It's time to build!

6. GROWING IN CONTAINERS ON THE ROOFTOP: A TECHNICAL GUIDE

How to choose, construct and maintain growers

There are many different ways to garden on rooftops depending on what type of garden you choose: in concrete or wooden containers or simply in growing medium spread on the roof that is irrigated by an automatic or manual system. Here, we give you the approach we chose for our *Rooftop Garden* project, i.e. the construction of growers using recycled containers.

Over the years, we experimented with different types of growers and different gardening techniques that went from traditional containers to hydroponic agriculture. We finally chose growers with a water reservoir, which became our favorite model. They are affordable, efficient in water autonomy, allow plants to be fertilized using homemade compost, movable and adaptable. These qualities make them an excellent tool for gardening on rooftops, but also on balconies, terraces and any other urban area where it is normally difficult to grow plants. To make starting your garden easier and to inspire those who are not as good with their hands, the project team designed a pre-made ecological grower, our "Ready-to-Grow" kits. You can communicate with us if you would like one (or more!).

Even though this technical guide focuses on certain details related to choosing plants, composting and fertilizing growers with water reservoirs, it is not a gardening guide per se, but rather a collection of information and examples assembled to inspire you when you create your own above-ground gardening project. Each suggested type of agriculture responds to a list of criteria (economic, ecological, lightweight, easy to build and maintain, water autonomy, and superior quality and yield) to help you make choices. The guide ends with detailed instructions related to connecting your growers to a common water system, collecting rainwater and setting up a seedling table!

6.1 Traditional Container Gardening

- ✓ **Economic**
- Ecological
- Lightweight
- ✓ **Easy to build and maintain**
- Water autonomy
- Superior quality and yield

This is where gardening at altitude starts. A container is perforated to ensure good drainage and filled with potting soil enriched with compost and fertilizer.

Generally, the deeper and more voluminous the container, the more the garden will yield. On the other hand, a 20 cm depth of 20 to 40 L of growing mix will be sufficient for a determinant tomato. For lettuce varieties, a 15 cm depth of 6 to 10 L of growing mix will guarantee great results.

A little more water …

A small reservoir can be added to a container if it has not already been perforated. You can cut holes approximately ½ cm in diameter 2 to 3 cm from the bottom of the container at 10 cm intervals. As the bottom of the container will be saturated with water after rain or after watering, this technique only works for demanding plants (such as tomatoes, eggplants, squash, etc.).

Plants are irrigated at the surface until water overflows from the drainage holes so that the growing mix stays moist at all times. Given the heavy water consumption of vegetable plants, growers must be irrigated every day and sometimes twice a day once plants have come to maturity. Moreover, frequent traditional watering washes away nutrients and is tiring for the gardener. This is where the idea to use water reservoirs came from.

6.2 Classic Hydroponic Container

Economical
Ecological
✓ **Lightweight**
Easy to build and maintain
✓ **Water autonomy**
✓ **Superior quality and yields**

In hydroponic agriculture, roots develop in a nutrient solution made from soluble elements that are directly available to the plant. These fertilizers are generally synthetic, but there are organic versions that are, in comparison, expensive. Hydroponic agriculture refers to a mixture of techniques that vary according to the needs of cultivars and the agricultural environment in order ensure yield with optimal quality. This technique also has potential as it is lightweight and has great water economy. However, it requires electricity, specialized parts and special knowledge. Hydroponic gardening is generally done in a controlled environment (cultivating room, green house, shade structure), but small amateur gardens can flourish if gardeners have a flair for technology!

Several hydroponic grower models are for sale in specialized shops. We, however, suggest you make them yourself for a fraction of the price. Here are instructions for constructing a self-irrigating grower that works using the Venturi system. This is a model that can be designed using recycled materials and built relatively easily. It is activated with an air pump rather than with a more costly water pump.

6.2.1 Recipe to Create a "Venturi" Hydroponic Grower

This container will take the form of a bucket with inert substrate suspended over a reservoir of nutrient solution. A small aquarium pump will force air into a tube that is submerged in the solution. When bubbles come up, they will transport small quantities of nutrient solution to the surface. This solution will percolate through the substrate, feeding the plant with water and nutrients before returning to the reservoir.

Drilling and Cutting Tools

Putting together the growers we propose requires using an electric drill and, sometimes, even a jig-saw. If you have never worked with these tools, ask a friend to show you how to use them safely. To cut plastic with a jig-saw, use a blade for metal and wood that has small teeth. If you prefer using a hand saw, chose a small hand saw used for cutting wood. Depending on the size of holes to drill, you can use one of the following drill bits:

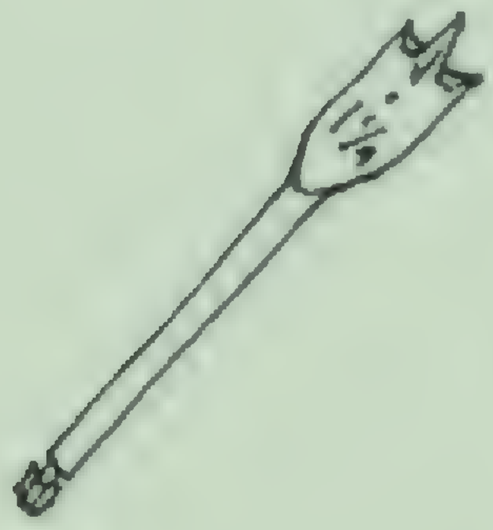
Spur Point Bit

Bits for wood are different from bits for metal. The pointed end stabilizes them in the material that is being drilled. They are available in all diameters up to ½ in. Affordable and efficient, these bits are ideal for making small holes in plastic. If you already have a set of metal drill bits, these will probably do the trick, but you will have to pay careful attention when you start drilling as the bit will tend to slide on the surface.

Flat Wood Bit

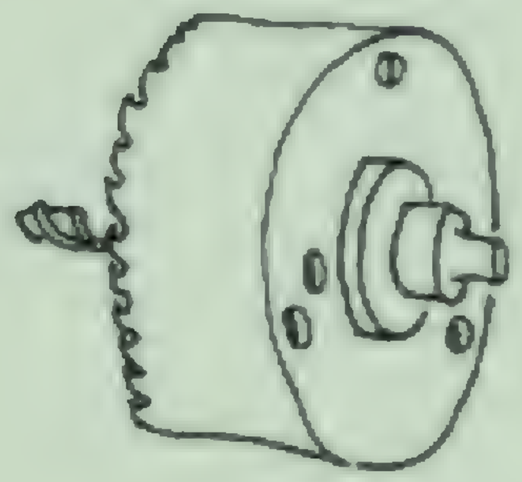
Flat wood or spade bits have flat heads that can drill larger holes than spur point bits (up to 2 in. wide). In addition to the central spur, you should also make sure it has another point on the left and the right sides. They are essential for cutting plastic. Only get the necessary diameters as flat wood bits are more costly than twisted bits.

Make sure that the container to be drilled is solidly tied to the floor. Ask a friend to help you if necessary. Keep the bit perpendicular to the surface you are drilling. Begin drilling gently until the points on the sides trace the hole's diameter on the surface. Then, pick up speed near the end of the drilling. Let the bit go through the surface completely so as not to damage it.



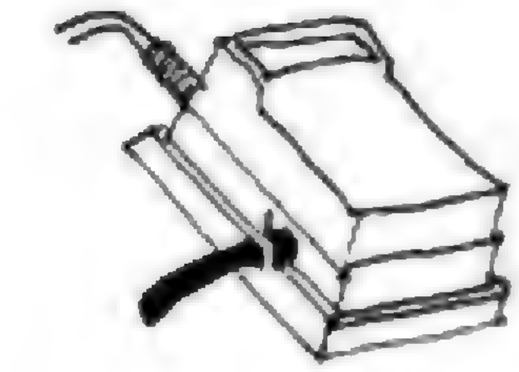
Hole Saw

You can use a hole saw if you aren't able to cut holes over 2 in. using a utility knife. Available in formats varying from ⅝ to 5 in., these drill bits are often very useful, but generally very expensive. Get a basic kit from the hardware store or rent the largest formats from a tool rental center. Use hole saws on a handheld drill following the same guidelines as those for the spur point bit.



Hollow Punch

If you don't want to use an electric drill, you can get a set of hollow punches at specialized hardware stores or at the cobbler shop. With a hammer, these tools will allow you to make holes up to ¾ in. wide in flexible plastic less than 3 mm thick. Put the piece on scrap wood, place the hollow punch at the desired spot and hit it with a hammer until it goes through the plastic.



The air pump.

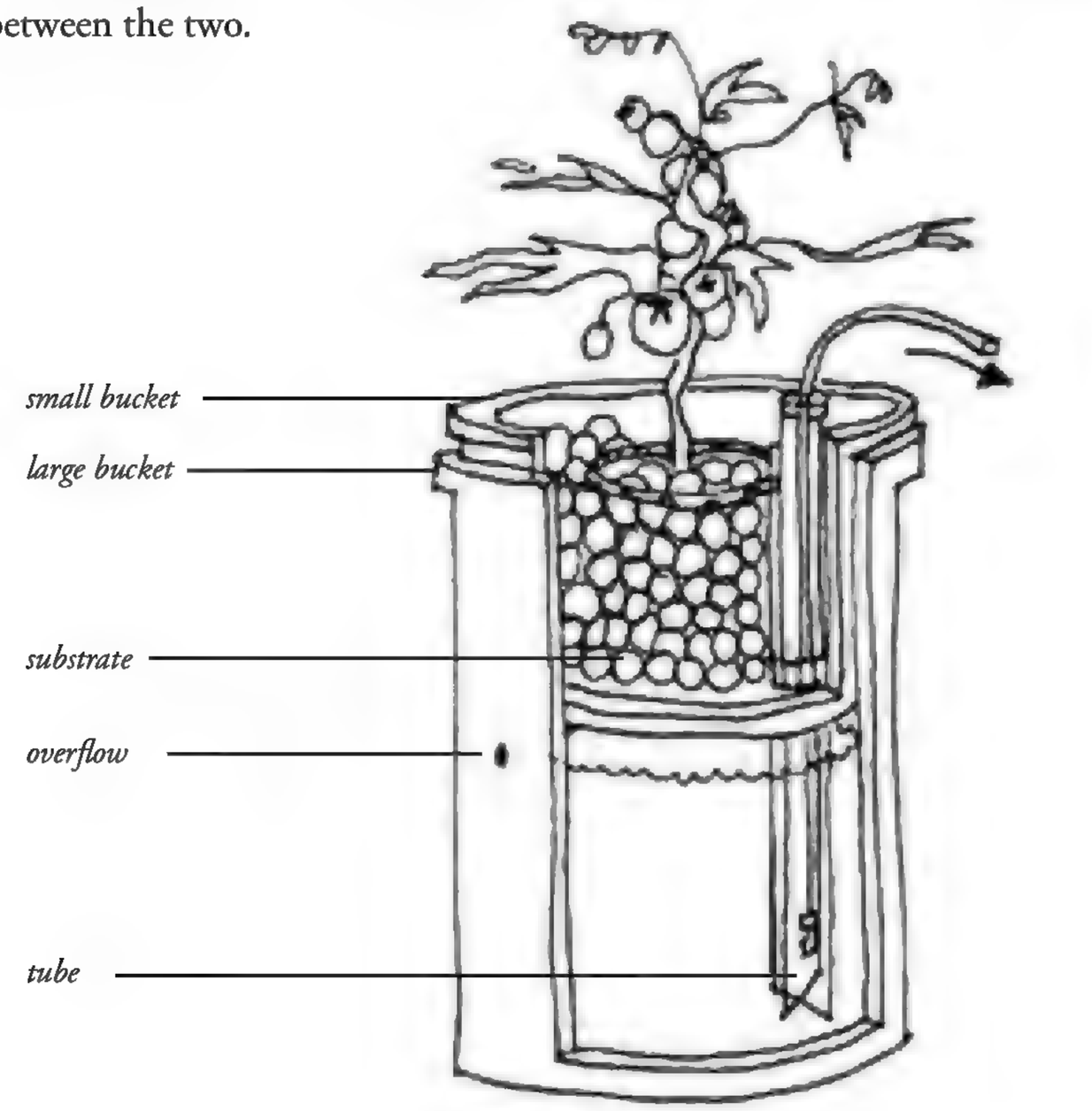
Materials

- 1 - 20 L (5 gal.) bucket
- 1 - 8 to 12 L (2 to 3 gal.) bucket that will sit in the larger one
- 1 aquarium air pump
- 1 to 2 m of air tube for the pump
- 1 rigid plastic tube, ¾ to 1 in. in diameter as long as the height of the assembled buckets
- 1 m of black or very dark, flexible plastic tube, ⅜ in. in diameter
- 1 - ⅜ in., tee fitting
- 8 to 12 L of inorganic and porous substrate (expanded clay pellets, volcanic rocks, etc.)
- 4 small tie wraps (zip ties)
- Hydroponic nutrient solution

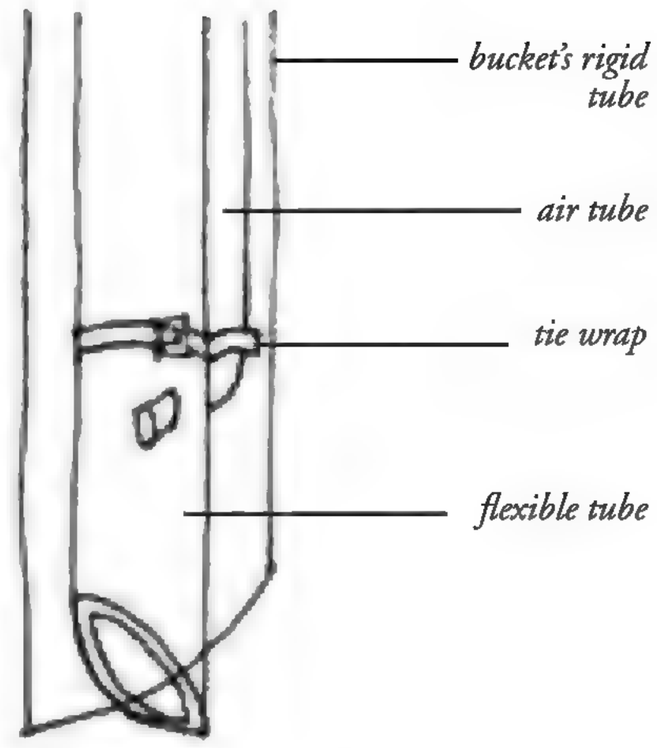
Equipment

- Drill
- Scissors
- Saw
- Utility knife

1. Drill a hole slightly smaller than the exterior diameter of the rigid plastic tube close to the edge of the bottom of the smaller bucket.
2. Drill 20 to 30 drainage holes using a ¼ in. bit in the bottom of the little bucket.
3. Sit the small bucket in the large bucket, and drill the overflow in the side of the large bucket 2 cm from the bottom to be sure there is an air space between the two.



4. Cut the rigid tube 3 cm shorter than the level of the assembled buckets.
5. Cut one end at an angle to ease movement of water, and insert the tube in the small bucket.
6. Insert the ⅜ in. flexible plastic tube in the central end of the tee fitting. Insert this tube in the rigid tube so that the fitting is sitting on the flat end (not the angled one). Cut the flexible tube at the level of the angled end, and remove it from the rigid tube.
7. Cut the end of the flexible tube at an angle. Carefully make a small hole for the air pump's tube at 2 cm above the angled end using a drill or a utility knife.
8. Cut the end of the air pump tube at an angle. Insert it into the hole cut in the flexible tube while keeping the interior passage of the flexible tube free.
9. Carefully attach the two tubes together at 2 cm from the hole with a tie-wrap, taking care not to block the movement of air in the tubes. Attach the tubes in three more areas and cut off the excess.
10. Place the assembled tubes in the rigid tube in the bucket. Insert a supple ¼ in. tube in both ends of the tee fitting so as to create a hoop a few centimeters smaller in diameter than the bucket.
11. Perforate it with irrigation holes measuring ⅛ in. at 5 cm intervals on the bottom side of the hoop, facing the bucket using a drill or a utility knife.
12. Fill the small bucket with pre-washed substrate and the water reservoir by watering the substrate at the surface. Connect the air tube to the air pump, and turn it on.
13. Carefully wash the roots of a plantlet in water in order to remove any trace of soil. Put it in the substrate in the center of the band so that the roots go toward the bottom of the small bucket.
14. Add soluble hydroponic fertilizers in the reservoir following the instructions.
15. To fill, prepare a nutrient solution in advance, and water the surface of the substrate before the reservoir contains less than 5 cm of liquid.
16. Change the nutrient solution, and clean the reservoir with a brush one to two times a month to prevent harmful accumulation of nutrients and pathogens.

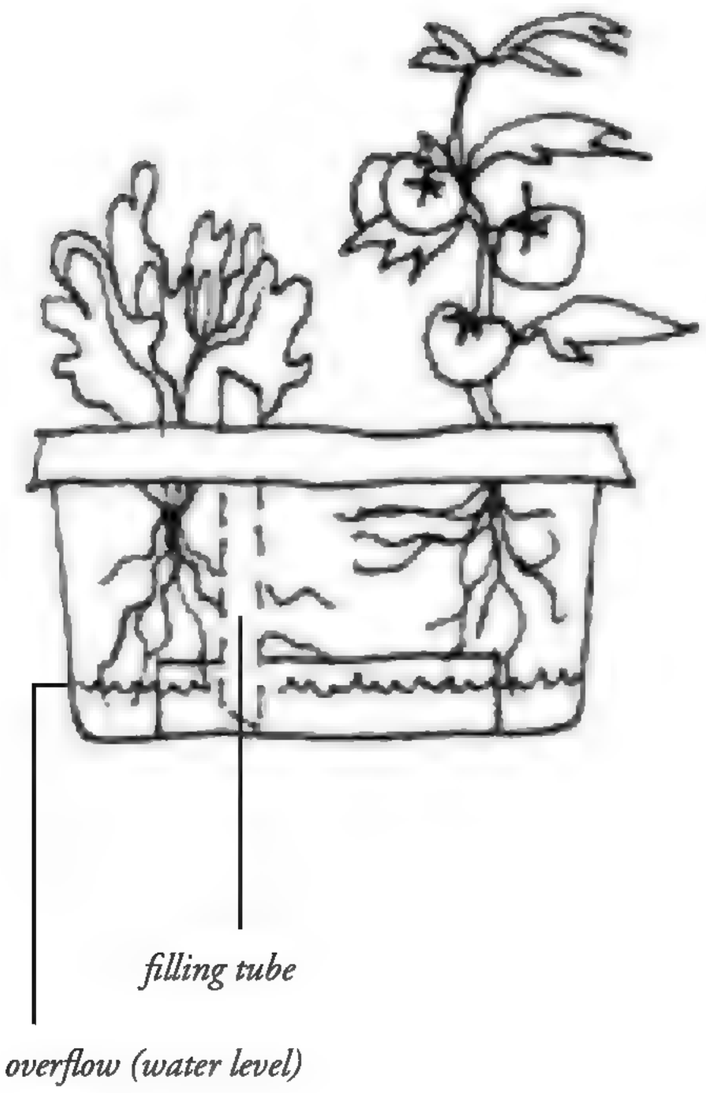


Assembled tubes in the bucket's rigid tube.

6.3 The Grower with Water Reservoir

- ✓ **Economical**
- ✓ **Ecological**
- Lightweight
- ✓ **Easy to build and maintain**
- ✓ **Water autonomy**
- ✓ **Superior quality and yield**

Adding a water reserve to a traditional container keeps gardening simple while considerably reducing the frequency of watering. The perfect solution for a hip balcony gardener!



A mature tomato plant can "sweat" out over 4 liters of water per day through transpiration. Capillary movement created by the sweating of leaves transports water and soluble nutrients in the plant. The constant presence of water optimizes the growth and the health of the majority of vegetable plants as long as it does not keep oxygen from being present in the soil.

The grower with a water reservoir is very simple. Allowing a small portion of the growing mix to be in contact with the water in the reservoir is sufficient to make the system work. A pot, a basket or a perforated tube installed between two containers and filled with potting soil acts as a wick that transports water from the reservoir to the roots. A simple overflow hole separates the water reservoir from the growing mix, ensuring adequate air to roots at all times. The size and form of containers is left up to your imagination, as long as the following criteria are respected.

Building Details for a Grower with Water Reservoir:

Percentage of the false bottom to be in contact with the reservoir: 5 to 15 %
Ideal (and maximum) length of the wick: 15 cm (20 cm)
Irrigation radius of the wick: 20 cm
Maximum distance between wicks: 40 cm
Air space (distance between the overflow and the false bottom): 1 to 3 cm

6.3.1 Recipe for a Bucket Grower with Water reservoir

Materials

- 2 – 20 L (5 gal) buckets
- 1 large tube or rigid container approximately 10 cm (4in.) in diameter and 15 cm long (reused ABS or PVC tubes are ideal)
- 1 pipe, 1 in. in diameter and 60 cm long
- 3 tie wraps
- 12 L of potting soil
- 10 L of compost
- Organic fertilizer

"Ready-to-Grow" Start-up Kit

To inspire citizens that are not as good with their hands to garden, the Rooftop Gardens team designed a pre-made ecological grower, the "Ready-to-Grow" kit, made from 95% recycled plastic. It has a 50 L growing mix capacity and its large 14 L water reservoir will enable you to cultivate superb vegetables on your balcony despite your many weekends spent away in the countryside.

Don't wait to start your garden, and support our project at the same time!

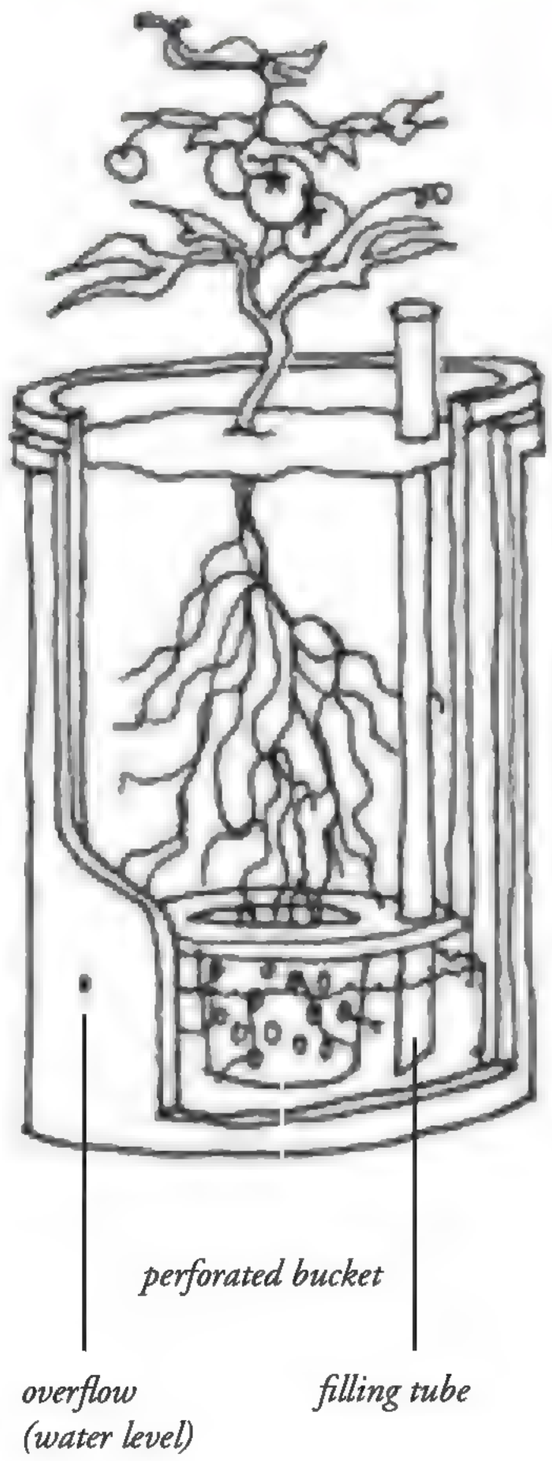
Contact one of us now to get a grower.

http://www.rooftopgardens.ca

Equipment

- Drill
- Marker
- Hand saw or jig-saw
- Utility knife

1. If necessary, cut the large 15 cm pipe using a saw.
2. Cut the end of the small tube at an angle.
3. Turn the bucket over, and center the large tube on the bucket's bottom.
4. Using a marker, draw the **interior** perimeter of the tube and three attachment points between the bottom of the bucket and the pipe.
5. At 2 cm from the edge of the bottom, draw the **exterior** edge of the small pipe.
6. Drill the attachment points in the pipe and to the bottom of the bucket.
7. Drill at least 20 drainage holes in the bottom of the bucket using the same bit.
8. Drill the two circles drawn with the marker using a flat wood bit and a hole saw. If you do not have these specialized bits, drill a ½ in. hole on the two circles drawn on the bottom of the bucket, and carefully cut them out using a utility knife or a jig-saw.
9. Attach the large pipe to the bucket using tie wraps.
10. Place the perforated bucket into the second bucket, and insert the angled end of the small pipe in the hole that was made for it.
11. Drill an overflow on the outside of the bucket at 1 cm below the bottom of the inside bucket.
12. Fill the large tube with wet potting soil, and solidly compact it.
13. Fill the grower with 10 L of potting soil and 10 L of compost. Add ⅔ cup



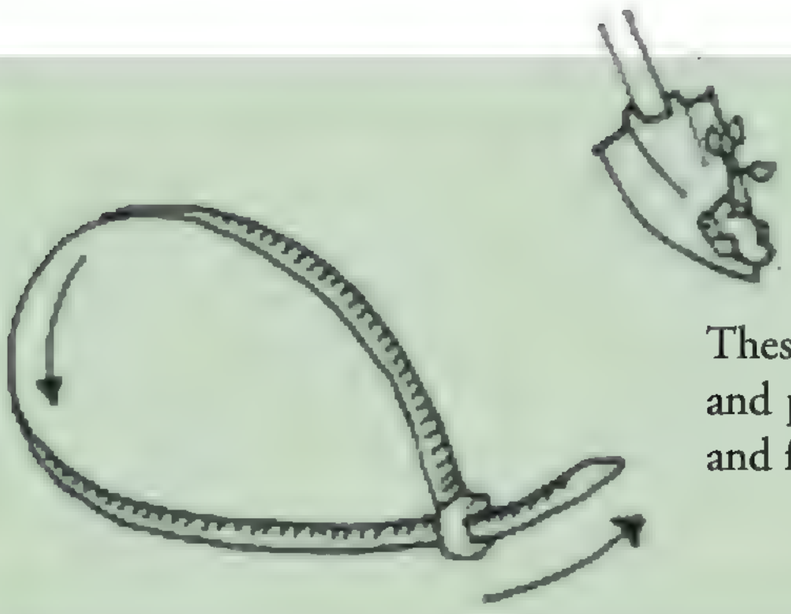
of dolomitic lime to the soil if you are placing a fruiting plant in the grower (tomatoes, peppers, etc.).

14. Mix 1/3 cup organic fertilizer in the first 10 to 15 cm of growing mix.
15. Transplant the vegetable plant of your choice and water the surface of the growing mix (do this only when you plant or if the growing mix dries over the summer because of a prolonged lack of water to the reserve).
16. Fill the water reservoir through the filling tube until the overflow spurts out water to avoid washing away nutrient elements.

6.3.2 Recipe for a Half-Barrel with Water Reservoir

Materials

- 1 food grade barrel
- 1 – 8 to 20 L bucket
- 4 large tie wraps
- 2 – 50 cm long pieces of synthetic rope that is at least ¼ inch thick in diameter



Tie Wraps

Tie Wraps (or zip ties) are indispensable tools for the builder-recycler. These small, nylon fasteners enable you to assemble small parts in a solid and permanent way. Make sure to insert the correct end into the opening and firmly tighten.

Where to find materials

Buckets

Scout streets and alleys the night before or very early in the morning of recycling and garbage days. Favor business streets for larger quantities. Pay particular attention to the residues in the containers. If they do not seem to be from food, leave them where you found them!

If you aren't up for a treasure hunt, ask restaurant owners or bulk dealers to keep their empty containers for you. Once you have explained your project, they will probably be pleased to help you. We had a lot of success with companies specialized in selling grape juice for wine-making. Visit them during the fall, when they harvest grapes.

Food Grade Barrels (Import Barrels)

These food-safe barrels are used to import large quantities of oils, sauces and bulk canned foods. Once the barrels are empty, most bulk dealers give them to middlemen specialized in reselling the used containers and palettes outside the city. If you have access to a car and travel regularly to the countryside, keep an eye out for pyramids of empty barrels on the side of the road. These companies will sell you the barrels for the modest price of $10-$25 per unit.

On the other hand, keep in mind that there are often barrels that get in the way of smaller bulk dealers that don't have large enough quantities to interest a middleman. Look in your phone book for bulk food stores near you. Ask them to call you when they need to get rid of their barrels. They will probably give them to you for free.

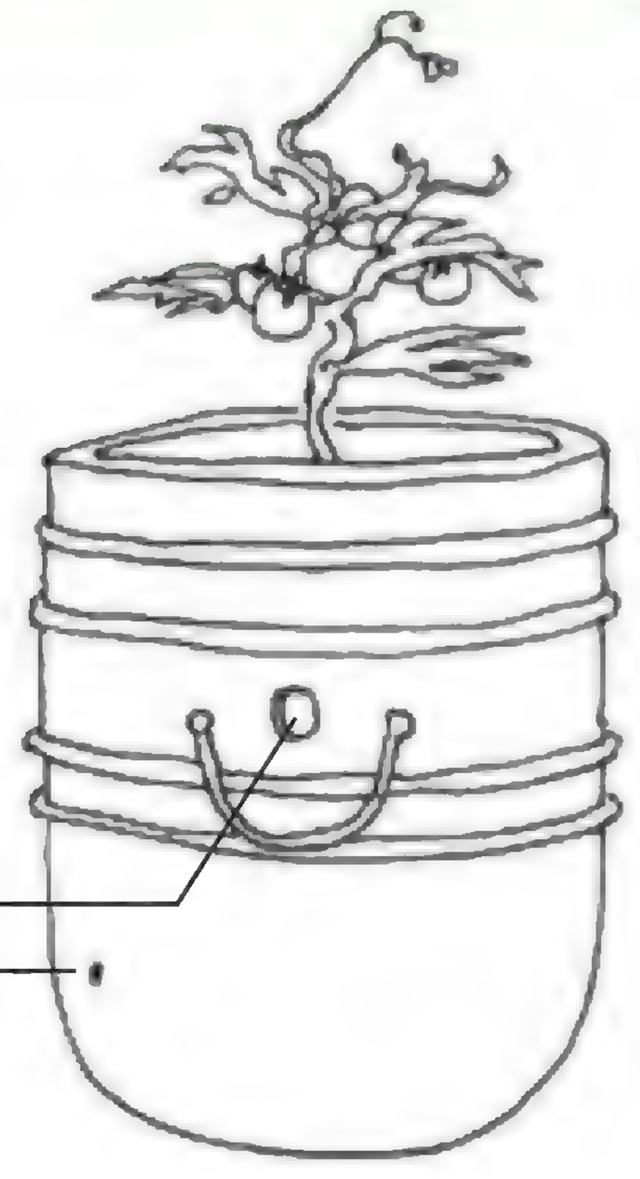
Specialized Parts

Though you can find the majority of parts for your growers in the hardware store, certain are more specific and available only in stores specialized in hydroponics. These parts include: the float valve, Carlon tubing (vinyl tubing), fittings and through-hulls. Give them a call before going to make sure they have everything you need in store.

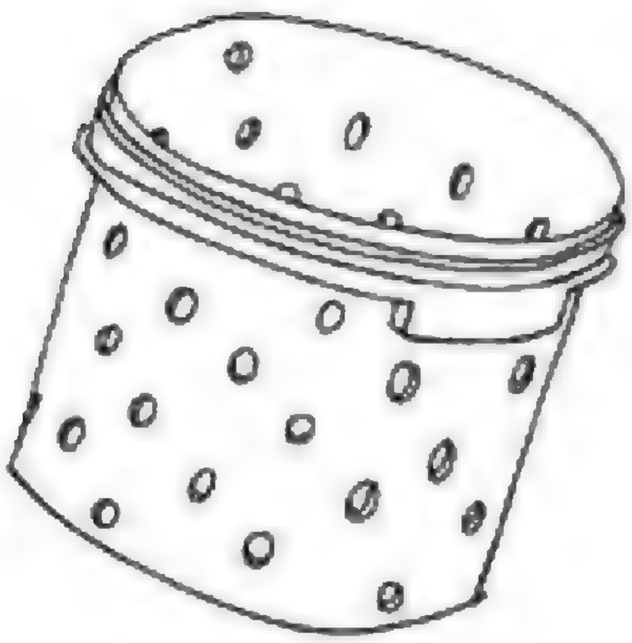
- If the barrel does not already have handles, 1 tube that is 1 in. in diameter and ¾ the height of the barrel (optional)
- 50 L of potting soil
- 30 to 50 L of compost

Materials

- Measuring tape
- Marker
- Drill
- Jig-saw

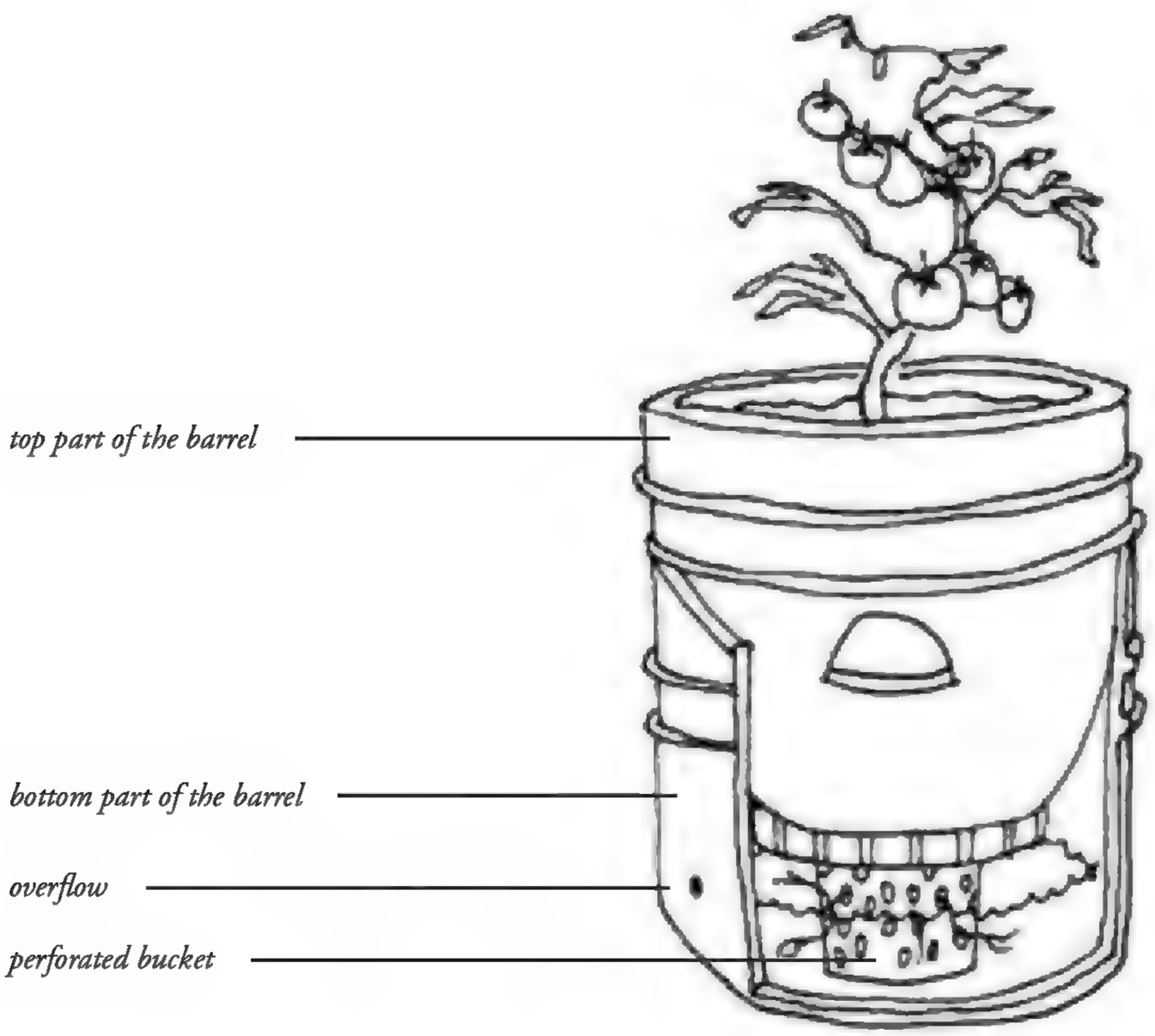


1. Remove the barrel's lid.
2. Draw a line at half the barrel's height with a marker.
3. Drill a hole that is approximately ½ in. wide at half the barrel's height.
4. Insert the blade of the jig-saw in the hole. Cut the barrel along the line.
5. Turn the top part over, set it inside the bottom part and push it down as far as you can.
6. Measure the height between the bottom of the barrel and the opening for the lid. If the height is greater than 20 cm, cut the edge of the lower part of the barrel to reduce the height to 15 to 20 cm.
7. Cut the top of the small bucket if necessary to get the same height as the distance between the barrel's bottom and the opening for the lid.
8. Perforate the sides and the bottom of the small bucket at 5 cm intervals using a ⅜ in. drill bit, and perforate four assembly holes at equidistance on the top edge.
9. Draw a 20 cm circle in diameter in the middle of the barrel lid.
10. Drill a hole of approximately ½ in. wide on the line, and cut the circle along the line using a jig-saw.
11. Put the edge of the bucket in the middle of the lid, trace the outline, and mark the four assembly holes.
12. Remove the bucket, and drill a ¾ in. hole on each side of the line on the lid facing the four assembly holes on the bucket.
13. Using tie wraps, solidly assemble the edge of the bucket to the top of the lid.
14. **If the barrel has handles**, measure and mark their place on the barrel facing the bottom part and, therefore, the outside of the grower. Take out the top part of the barrel, and drill a filling hole at least ¾ in. wide in the bottom part of the barrel. Drill two, ¼ in. holes 15 cm from each side of the filling hole. Drill two identical holes on the opposite side of the barrel. **If the barrel does not have handles**, drill a hole approximately 1 in. wide in the edge of the lid. Cut the other end of the optional rigid tube, and insert it in the hole. Cut the other end of the filling tube if it is necessary and according to your preference. Drill two ¼ in. holes 15 cm from each side of the filling hole. Drill two ¼ in. identical holes on the opposite side of the barrel.
15. Make a knot at one end of the rope. Put the rope through one of the ¼ in. holes keeping the knot inside the barrel. Put the second end in the second hole, and knot it to create handle of the length you choose. Install the other handle on the other side of the barrel.
16. Put the top part of barrel back in the bottom part. The bucket should rest on the bottom of the barrel while the two halves of the barrel hold it solidly in place.



The little bucket with its sides perforated.

17. Fill the bucket with wet potting soil. Compact solidly.
18. Fill the grower with a 1:1 or 2:1 ratio of wet potting soil and compost. Add 1½ cups dolomitic lime to the soil if the grower is for a fruiting plant (tomato, peppers, etc.). Mix 1 cup organic fertilizer in the top 10 to 15 cm of growing mix.
19. Fill the water reservoir through the hole or the filling tube until water comes out of the overflow.
20. Transplant the vegetable plants of your choice, and water the surface of the growing mix (only do this when planting or if the growing mix dries out in the summer because of a prolonged lack of water to the reservoir).
21. Fill the water reservoir regularly through the hole or the filling tube until water comes out of the overflow to avoid washing away nutrients.



Standing Funnel

Manually filling your growers' water reservoirs will be a lot easier if you use a funnel. If you have several growers, make life easier by building a self-supporting funnel. Hooray for simplicity!

Materials

- 1 large funnel with a narrow cylinder
- 1 m of semi-rigid tube that is about ⅝ in. wide (watering hose, Carlon tubing)
- 1 wooden rod or stiff bamboo around 1 m long
- 1 hose clamp
- 3 or 4 self-blocking fasteners

Equipment

- Marker
- Scissors
- Drill
- Saw
- Screwdriver

1. Determine the ideal height of the funnel on the rod, and mark that spot with a marker.
2. Cut the wood.
3. Drill two holes with the diameter of the tie wraps in the middle of the piece of wood at 3 to 5 inches from the end.
4. Insert the funnel's cylinder in one end of the tube, and solidly join them together using the hose clamp.
5. Attach the cylinder to the rod by placing the part of the funnel where the cone and the cylinder meet on the drilled end.
6. Insert a tie wrap in each hole, and pull them tight. If necessary, use extra wraps to stabilize the funnel.
7. Cut the excess off the fasteners with the scissors.
8. To fill the reservoir, place the funnel tube in your grower's filling tube. Fill the funnel using a watering can.

6.3.3 Choosing Plants

A Few Selection Criteria

Environment

Opt for plants that will flourish in the conditions you give them. Pay special attention to sunshine in your garden. Leafy plants need at least six hours of sunshine, and eight hours are recommended for fruiting plants. Depending on the time of year you start your garden, it might already be too

late for certain varieties. For example, sun-loving plants (tomatoes, eggplants, peppers) must be started from seeds inside at the beginning of April whereas onions and peppers should be started as early as the end of February! If you do not have the time or if you are not yet at ease with indoor seedlings, don't worry. Many varieties of plantlets are available in public markets and gardening centers.

Space

Favor plants with high yield that take up less space to optimize available resources. Think of the size of plants in relation to the expected harvest. Thus, tomatoes, peppers, lettuce and fine herbs might be favored, for example, over squash, broccoli, corn or artichokes.

Choose dwarf varieties whenever possible. Determinant tomatoes, for example, will like your grower a lot more than their indeterminate cousins. Along the same lines, dwarf beans and small summer carrots like the "Nantes" or "Little Fingers" varieties will win you over because they are extremely well-suited to container gardening.

Given that plant growth is limited by available space for roots, the bigger the container, the better the harvest. Nevertheless, by planting fruiting plants like tomatoes, eggplants, cucumbers, melons and squash in growers with a depth of over 25 cm, you will be rewarded with a satisfying harvest. Therefore, growers that are 20 cm deep can be used to plant peppers, carrots, peas and fine herbs, and those that are 15 cm deep can be used for lettuce, spinach, onions and beets.

Therefore, a plant must be chosen according to the container, but its neighbors must also leave sufficient enough space for it to spread out. An overcrowded garden will produce fragile plants that are not as productive as possible. Avoid making your little ones fight one another for fertilizer and sunshine by giving them enough space in the soil. Consult the table below to get a better idea of the number of plants that a grower can host without compromising their growth.

Recommended Quantity of Plants for a Grower with Reservoir

Type	Variety	"Ready-to-grow" kit	Bucket & reservoir	Half-barrel & reservoir
Fruiting plants	Determinant tomato	1 to 2	1	3 to 4
	Pepper	3	1	4 to 6
	Cherry tomato	2	1	2 to 3
	Dwarf beans	4	1-2	6 to 8
Non-fruiting plants	Basil	4	1	8
	Lettuce	6 to 8	3	10 to 14
	Edible flowers	4 to 6	2-3	8 to 10
	Fine herbs	4 to 6	1-3	6 to 10

Availability

Favor varieties of vegetables that are more rare and costly. You'll maximize your savings and impress your friends with your extraordinary dishes. Think arugula, basil, chives, nasturtium, cherry tomatoes and purple peppers!

Taste

Of course, don't forget about your personal preferences. Though a garden allows you to explore new flavors, there is nothing better than growing and harvesting your favorite vegetable.

6.3.4 Growing Mix and Compost

Growing mix is a lightweight alternative to soil sold in the spring at gardening centers, hardware stores and supermarkets. It is comes in two categories: **garden soil** and **potting soil**.

Garden soil is composed mainly of **black soil** and is not recommended for containers since it tends to get compacted. It is sold under the names black soil, miracle soil and peat moss.

Potting soil is a mixture of peat moss, vermiculite, perlite and compost that is specially formulated to ensure good water retention and good drainage in pots and containers. This product is also sold under the names potting mix, starting mix, growing mix or transplanting mix. Give priority to mixtures that are very lightweight and do not contain chemical fertilizers.

Compost is a fertilizer made from the decomposition of organic waste. Homemade compost or vermicompost is the ideal addition to your new grower since it will allow you to complete the food cycle at your own home. Make sure that the compost is ripe because a young mixture will absorb the nitrogen that is necessary for good plant growth. Many commercial varieties are also available (shrimp, sea weed, sheep and cow manure, etc.), and all of them are effective. Compost should make up 50% to 30% of the mixture's volume in order to ensure sufficient fertilization in micronutrients. A small quality of perlite (5 to 10%) can be added to guarantee good drainage if the compost is very dense.

6.3.5 Fertilization

Though plants get their energy from the sun, their growth is subject to the presence of a range of nutrients available in the growing medium. Compost provides most nutrient elements, but fruiting plants will need supplements of the major nutrients like nitrogen, phosphorous, potassium and calcium.

There are several quality organic fertilizers on the Quebec market. The major nutrients of fertilizing products are analyzed in laboratories and identified by three numbers on the tag. The numbers stand for the percentage in weight of available nitrogen, phosphorous and potassium, respectively. Products with a higher nitrogen content stimulate leaf growth while products rich in phosphorous encourage root, flower and fruit growth. As for potassium, it ensures vigorous growth and a healthy immune system.

If you are a beginner gardener, chose a balanced fertilizer for which the three numbers are similar and register between 2 and 8 (e.g. 4-4-2, 5-5-5,

An Overview of Composting at Home

The average Quebecer generates 1.5 tons of waste per year but transforms only 43% of it. About one third of residential waste could be composted. In a sanitary landfill, this biodegradable matter decays anaerobically, producing greenhouse gases and toxic liquids capable of contaminating our sub-surface water tables. On the contrary, when these precious resources are composted, they are transformed into a quality supplement for your garden. Reduce your ecological footprint now by taking up the art of home composting.

If you have access to ground space, learn about the subject before talking with your landlord and other building residents. Then, get a garden compost bin from your city, from the hardware store, or make one yourself using easy-to-build models that are available on the Internet. Keep brown organic materials (dead leaves, straw, shredded cardboard, etc.) to mix with kitchen waste and green garden waste. Start the process with the help of one of the many guides on the topic. Keep in mind that the larger the mass of compost produced, the better the result will be. So, invite your neighbors to participate in this social project!

Composting can also be done on a balcony, but it requires more careful management to make up for the lack of microorganisms in the soil and drier climatic conditions than in a garden. The balcony compost bin essentially works the same way as a garden compost bin, but it is generally smaller and has a false bottom for collecting excess liquids.

If you do not have a back yard or a balcony, don't be discouraged. You can get worms to do the work in your own kitchen! Vermicomposting transforms the year's kitchen waste inside the house. Once the red worms have been acquired and multiply to fit your needs, this technique becomes very efficient, pleasant and odorless. You must, however, acquire special worms from a vermicomposting friend, from an exchange network or from a company specialized in vermicomposting.

The worms are put in a bed of paper and moist compost in a container that is at least 30 cm x 40 cm and that has air holes and drains for excess liquids. Once or twice a week, a quantity of waste equal to the weight of worms is added to the vermicomposter. For more details, consult the many resources available on the topic on the Internet. Here is a challenge for enthusiasts: when your container is functional and overflowing with worms, double or triple your capacity so as to compost 100% of your waste. The worms will rapidly multiply to reach your vermicomposter's capacity.

4-6-8, 8-5-4). Generally, fertilizers richer in nitrogen are preferable for leafy plants and growth that leads up to flowering for fruiting plants. On the other hand, fertilizers with higher phosphorus and potassium contents are better for roots and flowering, fructification and maturation of fruiting plants (i.e., tomatoes, zucchinis, peppers, eggplants, etc.). Follow the instructions and the quantities recommended by the supplier. Even though they come from organic sources, these fertilizers can damage or even kill your plants if the concentration is too high.

Fertilizing a grower with water reservoir using organic fertilizers can be done in at least three ways: by adding dry fertilizers to the soil, by placing a fertilizing strip on the surface and by adding a soluble fertilizer to the water reservoir. Depending on the needs of the plants, these techniques may be used alone or in some combination.

1. Dry Fertilizers

Dry fertilizers cost less and last longer. They are generally mixed in the growing medium and kept moist as their availability depends on the presence of microorganisms that are able to break them down into nutrients.

Calcium

For fruiting plants like tomatoes and peppers, a calcium supplement at the beginning of the season will encourage abundant fructification and will prevent stem rot. Dolomitic lime is made of minerals and adds noticeable quantities of calcium and magnesium to the growing without throwing the pH out of balance. In spring, mix ½ to 1 cup of dolomitic lime for 25 L of growing mix before planting and repeat once during the season.

Basic Fertilization

As a general rule, you should follow the supplier's instructions for vegetable plants. The first fertilization will be done in the spring before planting; then supplements will be added throughout the season. Here is what we have learned from our experience: basic fertilization is sufficient for non-fruiting plants (basil, flowers, lettuce, arugula, etc.), but fruiting plants need additional nutrients provided by a fertilizer strip or liquid fertilizers. Consult the

Basic Fertilization Program for Dry Organic Filters

Type	Variety	"Ready-to-grow" kit	Bucket & reservoir	Half-barrel & reservoir
Fruiting plants	Determinant tomato	2/3 cup fertilizer at the beginning of the season + 1/2 cup per month	1/3 cup fertilizer at the beginning of the season + 1/4 cup per month	1 1/2 cup fertilizer at the beginning of the season + 1/2 cup per month
	Pepper			
	Cherry tomato			
	Dwarf bean			
Non-fruiting plants	Basil	2/3 cup fertilizer at the beginning of the season	1/3 cup fertilizer at the beginning of the season	1 1/2 cup fertilizer at the beginning of the season
	Lettuce			
	Edible flowers			
	Fine Herbs			

table we have provided for information on the fertilization program that we recommend for different types of growers with water reservoirs.

Fertilization Strips

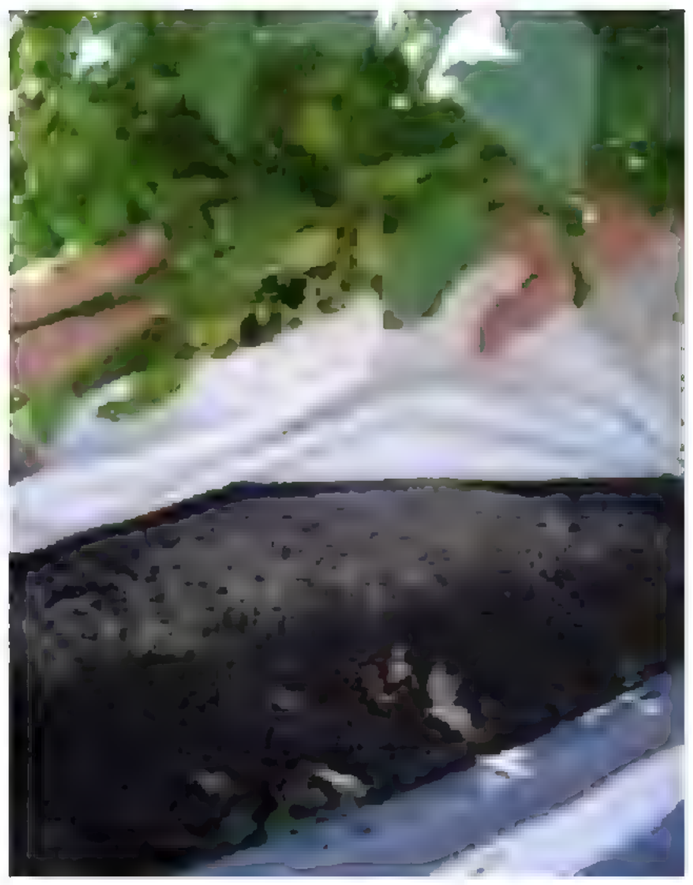
Most vegetable plants are selected for their capacity to produce an abundance of tasty vegetables in very little time. Therefore, they have a very fast metabolism and need relatively large quantities of water and nutrients in comparison to indoor plants. Consequently, the success of a vegetable garden in containers demands generous quantities of fertilizers as well as sharp attention from the gardener. Moreover, our experiences showed us that most plants with high fruit yields needed more nutrients than compost or dry fertilizers could provide for growing in a container.

One effective, alternative solution is to create a reserve of fertilizer in the grower that will be released progressively throughout the season. In growers with reservoirs, a dry fertilizer strip can be placed on the surface so that it will slowly dilute and transport fertilizers through the growing mix thanks to the capillary action of water.

To use this fertilization technique successfully, spread 1 to 1 ½ cups of dry organic fertilizer per fruiting plant on a strip that is 3 to 5 cm wide and the length of the grower after adding the dolomitic lime and the basic first-time fertilizers. Then, cover the strip lightly with a layer of growing mix to conserve moisture. Plants must be arranged so that they are approximately 10 to 15 cm from the fertilizer strip. In this way, their roots can easily spread without the risk of being burned by coming into direct contact with a high concentration of fertilizers.

A waterproof plastic mulch must be used with this technique because it prevents the fertilizer strip from being washed away by rain and will ensure a constant capillary movement of water in the growing mix. We will discuss the advantages of plastic mulch in more detail later on (see section 6.3.6).

Depending on the fertilizer used and the chosen plant varieties, there may be plants that could benefit from a change of fertilizer strip at mid-season. If plants show nutrient deficiency after one or two months of abundant growth, the mulch should be pulled back and the strip replaced by a new dose of dry fertilizers. Ideally, this second and last supplement should be done with a fertilizer that has low nitrogen content and is rich in phosphorus and potassium (e.g. 4-6-8, 2-5-8) because nitrogen encourages the growth of branches and leaves rather than the production of flowers and fruits that are expected at the middle of the season.



Soluble Fertilizers

Organic soluble fertilizers differ from dry forms by their quick action and higher cost. They are often sold as concentrated solutions in hardware stores and in gardening centers and are generally made of fish and seaweed extracts. A soluble fertilizer can ensure healthy growth in fruiting plants on its own, but the high cost favors occasional use in combination with dry fertilizers. It is also possible to experiment with your own nutrient solutions using wild plant and vegetable waste liquid extracts created at home.

If you want to give an extra nutrient supplement to your plants, mix half the recommended dose of soluble fertilizer with the water you use to fill your grower. Repeat fertilization two times more often than recommended to give the total dose to your favorite plants. This program will enable plants to have permanent access to nutrients without risking damage to their roots. For the

best results in fruiting plants, given the quick action of soluble fertilizer, you can replace your basic fertilization by a solution richer in phosphorous and in potassium after the first flowers have appeared. **It will rarely be necessary to use soluble fertilizer in addition to a fertilizer strip.**

6.3.6 Mulch

In natural conditions, soil is protected from bad weather by a layer of organic matter. When there is not a layer of freely growing plants, plant residues slowly decay under the careful attention of benevolent fungi and bacteria. There are numerous advantages to mulch. First, it retains moisture in the soil and, because of this, protects the surface roots and maintains the balance of organisms (worms, bacteria, etc.) that work to provide air to the soil and release nutrients that are indispensable for good plant growth. Second, it reduces erosion of the growing mix, moderates the temperature of roots and, in

Purins and Compost Teas

Purins are biostimulating, liquid fertilizers that come from healthy fermentation of organic materials. Choose your ingredients according to the plants' needs and stage of growth. Look at the grid below for ideas, but be creative. Prepare mixtures, inform yourself and experiment with what you have on hand.

Ingredient	Fertilizing composition
Burdock	N, K, Calcium
Compost	N, P, K
Comfrey	N, K
Cabbage leaves	N
Nettles	N, Fer
Dandelions	N, P, K, Calcium, Magnesium
Goldenrod	P, K, Calcium

To make a plant *purin*, put about 1 kg of freshly picked and chopped plants in a plastic bucket and add 10 L of water. Keep the bucket covered, away from the sun. Vigorously stir the mixture one or two times a day in order to guarantee healthy fermentation. It may let off unpleasant odors the first few days, but they will subside at the end of fermentation. In two or three days, you should see bubbles come up to the surface when stirring. When these disappear, approximately seven to 21 days later depending on air temperature, fermentation is finished. The liquid plant extract is ready for use.

To store *purin*, filter it and put it away from light in a sealed container.

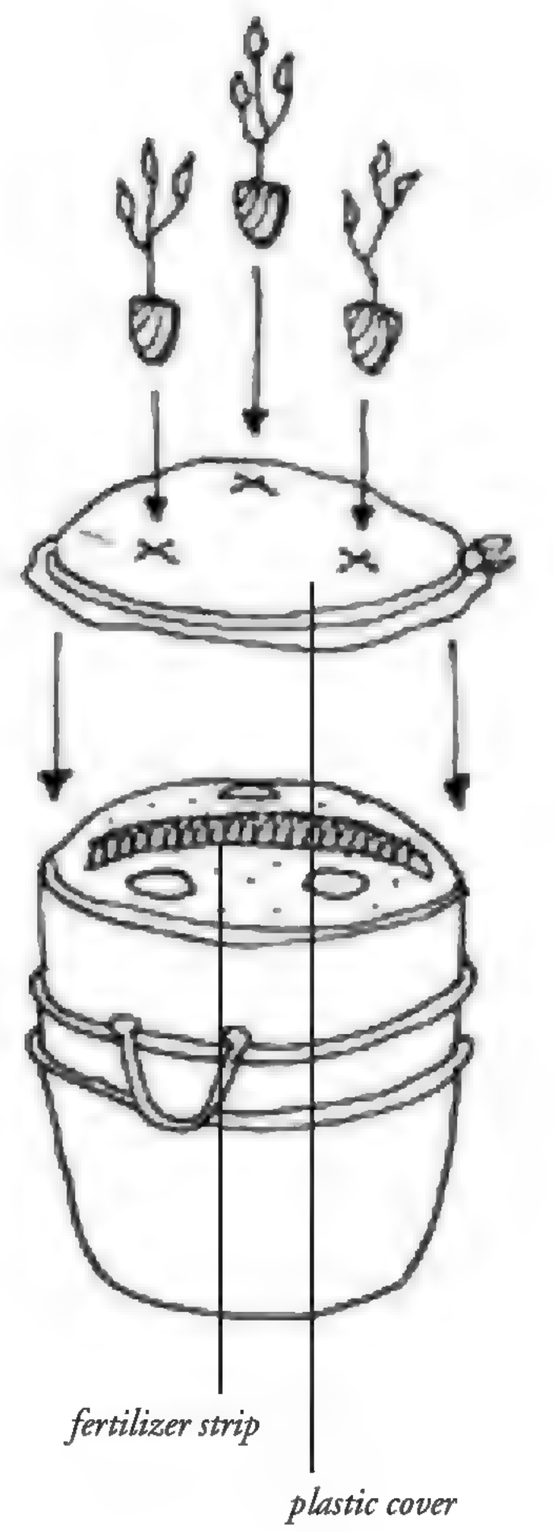
Purin must be diluted by 10 to 20 percent before use. If you are doing traditional container gardening, fertilize with diluted plant extract instead of normal watering. If you use growers with water reservoirs, fill the reservoir with diluted *purin*. Use this fertilizer according to your plants' needs, once or twice a week.

To make **compost tea**, place a given quantity of compost and 3 or 4 times its volume of water in a plastic bucket. Mix well and let sit for one or two days. Next, filter, store and use the tea according to recommendations given for *purins*.

the case of organic mulches, adds nutrients and organic matter to the soil.

In container agriculture, **organic mulches** (dead leaves, straw, wood chips, cocoa shell) are very beneficial if the grower can be placed in a way to prevent the mulch from blowing away. A layer 2 to 3 cm thick should be placed on the surface after the first seedlings sprout or when plantlets are transplanted. When the time comes to add fertilizer to the growing mix, simply lift the mulch and mix fertilizer with the first 2 or 3 cm of growing mix.

If you are using a fertilizer strip or are simply looking to maximize dry fertilizers added to the growing mix, you should use **waterproof mulch** to keep nutrients from being lost to the rain. After preparing the growing mix and completing the first fertilization, simply cover your grower with a garbage bag or a plastic tarp and solidly attach it by tying a cord around the container. Cut 10 cm "X"s in the plastic where you would like and plant your plants through the mulch. Avoid mulch made of transparent plastic as it can overheat the roots. Use black plastic for heat-loving plants (tomatoes, zucchinis, melons, eggplants, etc.) and white plastic for cool weather plants (peas, parsley, etc.). You can also be creative as it has been proven that red mulch improves productivity in tomatoes! If you have to replace the fertilizer strip during the season, undo the cord and lift up the plastic for easy access to the growing mix.



6.3.7 Closing the Garden in the Fall

Here are some guidelines to help you prepare your grower for the cold season.

- Once the harvest has ended and winter is in sight, stop filling your grower's water reservoir.
- Once the reservoir has been emptied and the plants have dried out from lack of water and the change of season, simply cut the plants to the level of the soil and incorporate the remains into your compost pile.
- To reduce the weight of your grower and accelerate the defrosting of the growing mix in the spring, empty the reservoir by turning it on the side of the overflow. Then, turn it upright, and cover it with a plastic tarp. Your grower is now ready to survive the winter!
- If you have to move the grower, this is the ideal moment to do so since it will now be a lot lighter.

6.3.8 Next Spring

Here are some suggestions to help you re-start your grower after the last frost.

After one growing season, the plants have consumed most of the nutrients of the compost in the growing mix. Root action and the microscopic life that accompanies it have also started to break down growing mix particles. Potting soil generally has a lifespan of two to four years after which its capacity for water retention and drainage will be reduced to the point that that the plants' health will be compromised. To guarantee good results every year and to extend the life of the growing mix, we suggest fertilizing it each spring.

To enrich the growing mix:

- remove approximately 10 to 20% of the growing mix from your container;
- prepare a mix of compost and soil similar to this one:
  80:75% compost
  20:25% perlite (to improve drainage);
- mix the contents of the grower to untangle and spread out roots from the previous year;
- fill the grower with the new compost mixture, and mix it in with the existing growing mix.

6.4 A Garden of Connected Containers

Economical
✓ **Ecological**
Lightweight
Easy to build and maintain
✓ **Water autonomy**
✓ **Superior quality and yield**

Like any living thing, a garden grows quickly and reproduces. If you have caught the urban gardening bug, you are probably already planning to set up new growers. That's great! However, if daily filling of numerous hydroponic growers or growers with water reservoirs is bogging down your initiative, you should consider the advantages of a garden of connected containers.

All of your growers can be connected to a central water reservoir equipped with a control valve that will ensure automatic filling. Not only can this system function on its own, it can also be connected to a rainwater collection system. Your balcony or terrace will be turned into a true urban oasis. Able to drink on their own, your plants will be free to feed as they please and will sing your praises as a master of permaculture.

The success of your connected garden depends on the efficiency of the valve and on airtight joints. Here, we suggest you construct a control box equipped with a float valve and fittings available at several hydroponics stores. You can also find the rest of the supplies at the hardware store.

6.4.1 Recipe for Constructing a Garden of Connected Containers

Materials

Control Box

- 1 flexible storage box or a plastic bucket with a lid that can hold a float valve
- 1 - ¾ in. automatic float valve
- 1 retaining nut for a countertop faucet
- 1 – ¾ in. female fitting and 1 – ½ in. male fitting
- 1 eyelet
- 1 - ⅝ in. elbow or tee fitting for Carlon tubing depending on the connecting system

Reservoir

- 11 food grade barrel or a large plastic container with a lid that can be perforated
- 1 – ⅝ in. through-hull and two washers

Network

- 1 - ⅝ in. eyelet per grower
- Straight, elbow or tee fittings for ⅝ in. Carlon tubing depending on the connecting system
- Stainless steel hose clamps for a ⅝ in. tube

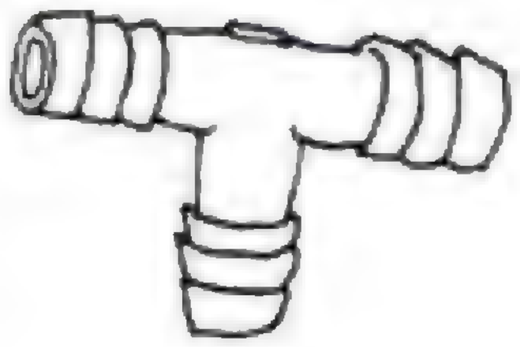
Equipment

- Drill and ¾ in. and ⅝ in. drill bits
- Multiple slip joint pliers
- Screwdriver
- Knife or scissors

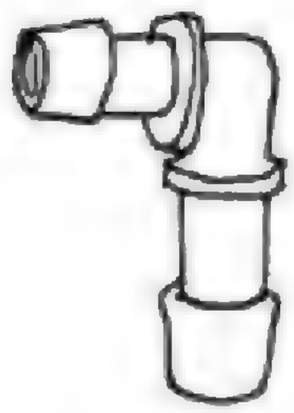
Design Plan

1. Do a sight check on the surface of the ground (or roof). It should seem level to you. No matter what surface the connected growers are meant to cover, any difference in levels should always be less than the height of the reservoirs of growers. **If the difference in levels is greater than the height of the reservoirs**, water will not circulate between communicating recipients as it should. However, **if the difference in levels is acceptable**, you can compensate for the slope after installing the series by putting bricks or wood blocks under individual growers in the series. If you do not trust your sight judgment, check if the surface is level as indicated on the following page.

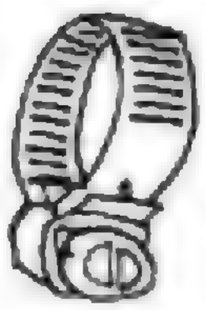
Eyelet.



Tee fitting.



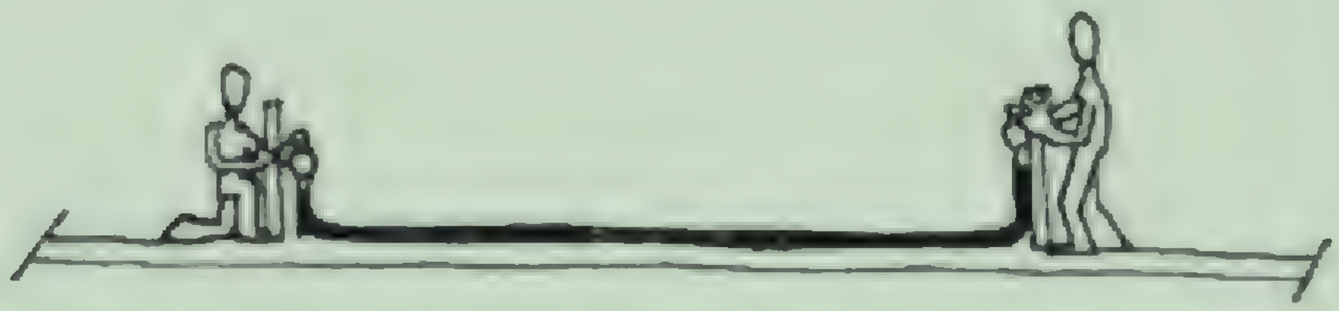
Elbow fitting.

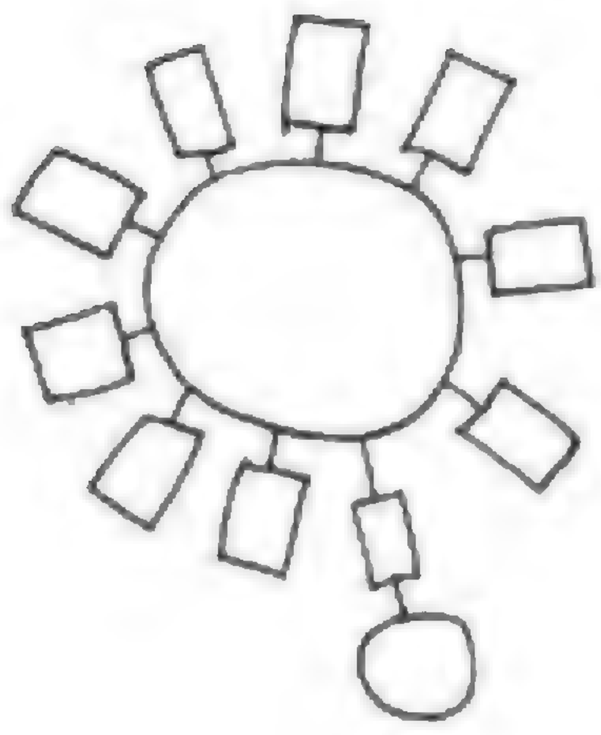


Hose clamp.

Checking the Surface Level

Get a small transparent plastic tube that is at least 5 m long and two measuring tapes. Ask a friend to help you. Fill the tube with water and hold one end at the corner of the garden. Ask your friend to pull the tube along the ground to the other corner while stopping up the other end with their thumb. Measure the distance of the water level in each tube from the ground. The difference between the two levels represents the total difference in levels. If the garden is bigger than the tube, repeat the steps in the same direction starting from the ending point and add the differences in level to calculate the total difference. Then, repeat the steps in the other directions of the garden to check the entire surface.





The Design Plan.

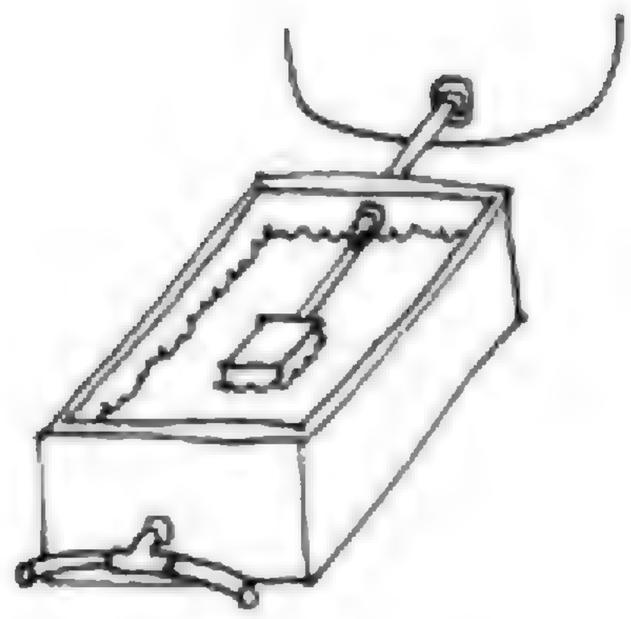
2. If you have not already done so, draw up a design plan for the garden on paper by drafting out the general floor plan as well as the placement of growers and the water reservoir (*see section 3.2*). The plans will show the network junctions and the link to each grower. It is important to place the Carlon tubing network strategically in order to minimize the number of joints and the risk of stepping on the tubes while gardening. Buy a few extra meters of Carlon tubing in case changes must be made.
3. In the garden, set up the reservoir, your growers and the control box as indicated on the plan. If necessary, don't hesitate to modify the design.

Control Box

1. Fill the container that will be used as a control box up to the level of your growers' overflow holes.
2. Put the float valve on the water, keep the valve in a horizontal position and push it down until the float's arm stops and tries to submerge the float. The controller is then full and the valve closed. It will open only when the water level goes down. Mark the height of the float valve's joint on the container and empty it.
3. Drill a ¾ in. hole on the joint mark.
4. Insert the fitting for the valve in the hole, and screw it in all the way making sure that the float valve's movement is vertical.
5. Tighten the valve's joint to the container wall using a retaining nut. The joint does not necessarily have to be air tight, but it should be solid.
6. Drill a ⅝ in. hole on one side of the control box at 2 cm from the ground.
7. Insert an eyelet in the hole and put the correct Carlon tubing connector on it according to the design.

Tank

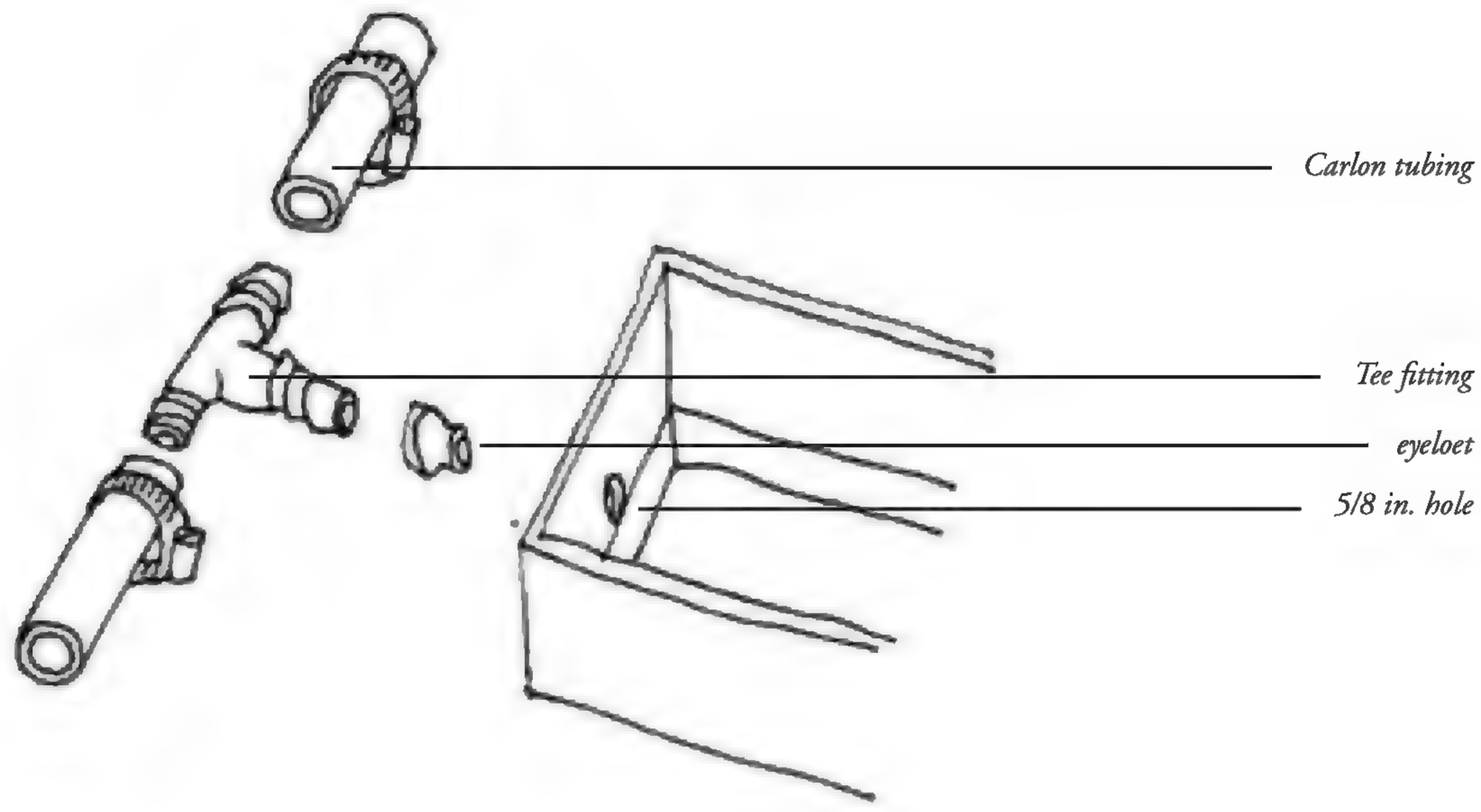
1. Drill a ⅝ in. hole on one side of the grower at 5 to 8 cm from the ground.
2. Install the through-hull in the hole taking care to insert a grommet on each side of the tank to prevent leaks. Tighten the through-hull well using a multiple slip joint pliers.



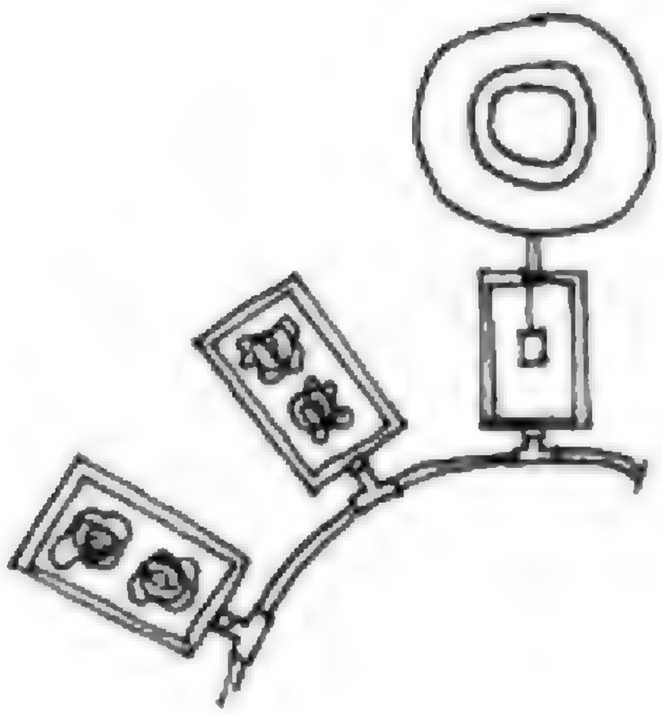
The control box.

Hooking up the Series

1. Drill a ⅝ in. hole on one side of the grower at 2 cm from the ground according to the design plan.
2. Insert an eyelet and install the appropriate Carlon tubing fitting on it.
3. Repeat steps 1 and 2 for all the growers to be connected in the garden.
4. Put the Carlon tubing connectors in the appropriate places in the garden following the design.
5. Measure the distance between the through-hull in the tank and the float valve connector in the control box. Cut a piece of Carlon tubing to this length.
6. Insert one end of the Carlon tubing into the hose clamp and put the through-hull in the tubing. Make sure that the connector is inserted all the way before tightening the hose clamp around the joint with a screwdriver. The hose clamp must be placed on the tubing and the center of the end of the through-hull for maximum sturdiness.



7. Repeat the preceding step to attach the other end of the tube to the float valve connector in the control box.
8. Repeat steps 6 and 7 to join the control box and the growers together according to the design plan.
9. Fill the tank and check if water flows from the float valve.



The control box in the series.

10. Come back to the garden a few hours later when the water stops running from the float valve. Check the joints of each fitting for each grower. Fix joints that leak.
11. Check the level of reservoirs for each grower. If the reservoirs of all the growers are full or half full, congratulations! The series is functional because the difference in levels of the garden is negligible. Otherwise, change the series according to one the following scenarios :

    - **If the reservoirs of all the growers are full and overflowing,** move the float valve arm using the screw that attaches it to the fitting to reduce the level of water in the control box. The valve's floater can be unscrewed a bit from the arm if necessary. Empty the reservoir of half of the growers. Wait a few hours and check the level of the reservoirs again. If the problem persists, drill a new, slightly lower hole for the float valve fitting on the side of the control box and reinstall it. Check the level of the reservoirs again.
    - **If reservoirs of only a few growers are overflowing and the level of reservoirs for the other growers is adequate,** empty the reservoirs of half the growers and raise the growers that are overflowing by propping them up on small wood blocks.
    - **If the reservoirs of all the growers are filled to less than 50% of their capacity,** move the arm and the float valve to correct the water level in the control box. Wait a few hours and check the level of reservoirs again. If the problem persists, raise the control box onto small wooden blocks until the water level of reservoirs for the growers is acceptable.
    - **If reservoirs for certain growers are filled to less than 50% of their capacity and the level of the reservoir for the other growers is adequate,** move the valve's arm and floater to correct the water level in the control box. Wait a few hours and check the reservoirs' levels again. If the levels are acceptable and none of them overflow, congratulations! If, however, some of the growers are overflowing, empty them and change their elevation by raising them up using small wooden blocks.

6.5 Collecting Rainwater

Economical
✓ **Ecological**
Lightweight
✓ **Easy to build and maintain**
✓ **Water autonomy**
✓ **Superior quality and yield**

Rainwater can become a significant environmental problem in large urban spaces. When the landscape and natural waterways are paved, rainwater that used to be absorbed by the earth before returning to the atmo-

sphere through plant transpiration must be absorbed by the sewer system. This increases the quantity of water that needs to be processed in a water treatment plant and causes considerable overflow of unfiltered water during rainy periods.

Reducing the quantity of water used at home and not emptying chemical products in the drains are effective ways of decreasing our impact on the quality of water in our lakes and in our rivers. If your building has an exterior rainwater drain, you can also install a rainwater collection system that will allow you to irrigate your plants with chlorine free water while you protect the quality of our ecosystems. Think about it - the quantities are great. For every centimeter of rain, one square meter of collection surface will yield 10 liters of water. Thus, for an average roof size of 10 meters by 20 meters, you could collect 2,000 liters or the equivalent of 10 barrels of rainwater!

6.5.1 Recipe for Constructing a Rainwater Collection System

Materials

- 1 or more used food grade barrels (approximately 200L)
- Mosquito net

For each additional barrel, you'll need:

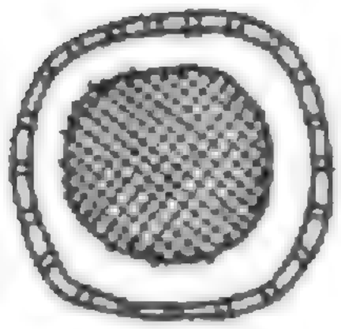
- 2 – 1⅛ in. through-hulls and 4 rubber grommets
- 30 cm or more of 1⅛ in. Carlon tubing
- 2 tie wraps

Equipment

- Pencil
- Drill and ½ in., 1⅜ in and 1½ in. drill bits
- Scissors
- Jig saw
- Metal saw
- Stapler
- Flathead screwdriver
- Multiple slip joint pliers
- Measuring tape

1. Find the gutter spout. **If the gutter spout is inside the building**, changes could be major and will require the hiring of a qualified engineer. However, **if the spout is outside the building**, changes will be simple.
2. Examine the spout to plan out the connection to a barrel.
3. If you are renting space in the building, talk about the project with your landlord and your neighbors.
4. **If the cover of your barrel has a ring and a grommet**, take off the ring. **If the lid is made of a single piece**, you must cut an opening measuring 30 to 50 cm in diameter. Trace the circle for the opening and cut a hole measuring approximately ½ in. on its perimeter. Put the jig saw blade in the hole and cut the opening.

5. Trace the contour of the lid on the mosquito net and cut it out.
6. Staple the mosquito net inside the lid so that mosquitoes and debris cannot enter. Put the lid back on the barrel.
7. Cut the gutter spout between 10 and 30 cm above the barrel lid using the metal saw. Change it using a gutter elbow or another extension if necessary. Put the barrel under the gutter.
8. When you need water, take the lid off and submerge a watering can or a bucket in the barrel. Don't forget to close the lid when you are finished to keep mosquitoes from breeding in your reservoir.



Mosquito net on the barrel lid.

To connect several barrels :

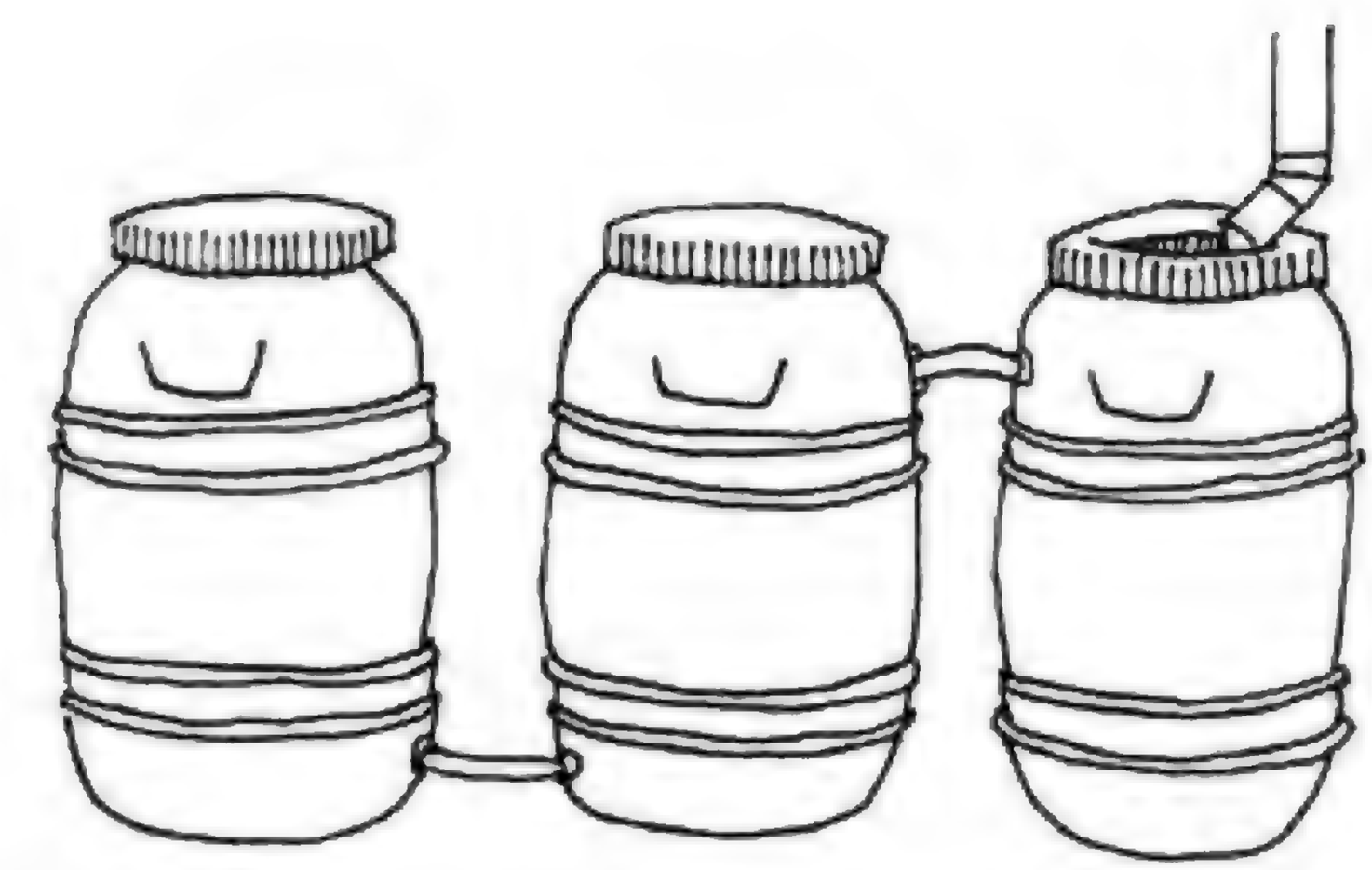
1. Put an additional barrel next to the first one;
2. Put a through-hull on each of the facing sides of the barrels at 10 to 30 cm from the lid. Depending on the form of the barrels and the height of the through-hulls, determine and mark the ideal spot for the through-hulls.

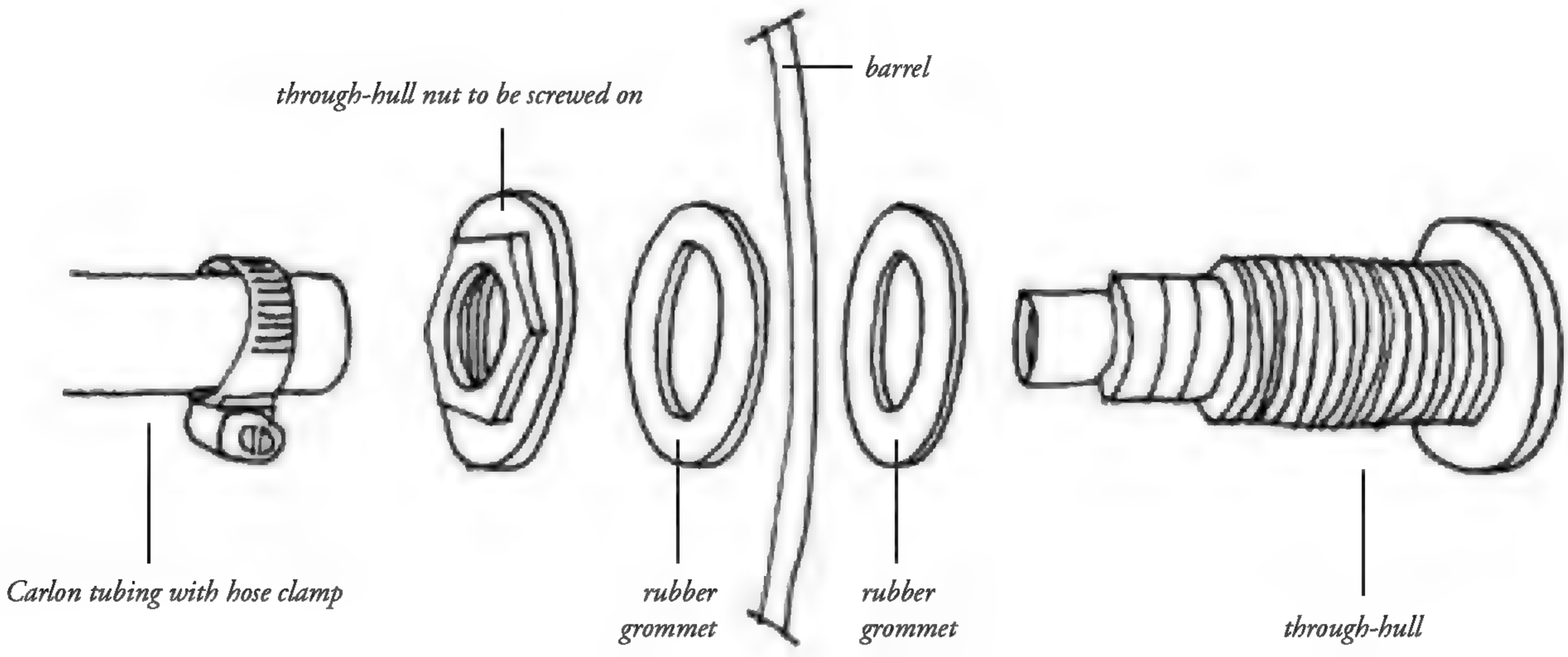
Connecting Several Reservoirs

Here is some useful advice if you plan on connecting several reservoirs :

- Ideally, the Carlon tubing that will be used as a connector should be straight to facilitate installation;
- If the tubing is curved, it still must be below the level of the lids in order to allow water to circulate;
- To reduce the number of joints and the risk of leaks at the same time, install extra connected barrels starting from the first barrel;
- **If you plan on watering the garden by hand using watering cans or buckets**, install connections between barrels on the sides, but just slightly below the lids. If there is not enough rain to fill all the barrels, the water will not get to the last ones before the first ones have been filled. This way, it will be easier for you to fill your watering can.
- **If you plan on hooking a garden of connected growers to your rainwater barrels**, calculate 5 liters of water per day of additional autonomy per fruiting plant. Connections between barrels will be installed as close as possible to the ground to maximize the movement of water to the control box. The connection to the control box for the garden in series can then be placed on any barrel.

1. Drill a hole approximately 1⅜ in. in diameter at the chosen place on each barrel.
2. Install the through-hulls as indicated on your design plan placing a grommet on each side of the barrels' walls to ensure air tightness. Tighten them using a multiple slip joint pliers.
3. Measure the distance between the through-hulls.
4. Cut a piece of Carlon tubing to this length.
5. Put both hose clamps on the tube.





6. Insert each through-hull's fittings in the ends of the tube. If the through-hull cannot be easily inserted in the tube, put it in boiling water for a few seconds to make it more flexible for installation.
7. Make sure that the fitting is inserted all the way before tightening the hose clamp on the joint using a screwdriver. The hose clamp must be placed on the tube and in the center of the end of the through-hull for maximum sturdiness.

6.6 Seedling Table with Water Reservoir

In a cold climate like ours, growing vegetables originally from warmer climates requires starting seedlings indoors. The controlled environment of a room or of a seedling greenhouse can reproduce the ideal growing conditions for these plants. The day will come, however, when the seedlings must acclimate to a colder environment and outside light. Therefore, seedlings in seed flats or in small pots are generally set outside for longer and longer periods before being transplanted definitively to growers or to the ground. When seedlings can stay outside for the entire night, you will no longer have to water them once or twice a day and will not be in danger of letting them dry out by putting them in a seedling table with a water reservoir.

The seedling table is irrigated according to plants needs via an air tight reservoir that only has one hole in contact with a layer of sand spread evenly over the surface. The reservoir can only be emptied if its contents are replaced by air, which means that it is only activated when the sand, and therefore the seedlings' growing mix, starts to dry out.

6.6.1 Recipe for Building a Seedling Table with Water Reservoir

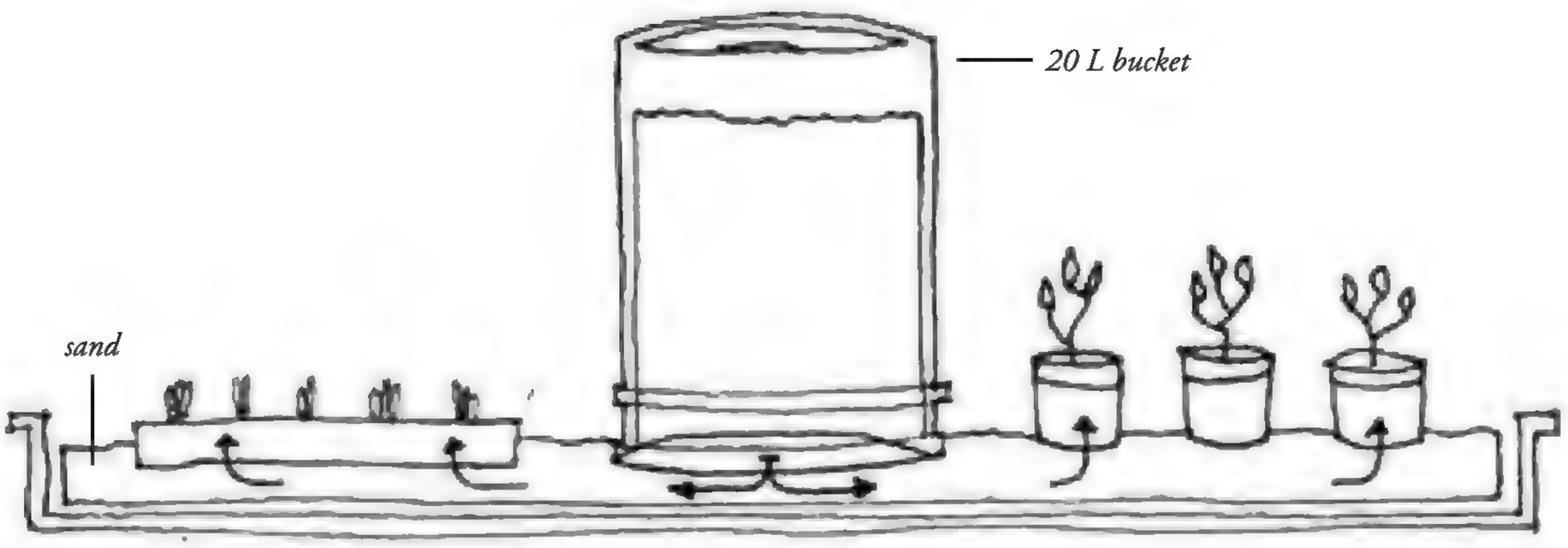
Materials

- 1 recycled 20 L (5 gal.) bucket with an air tight lid
- A ground space or raised table measuring 1 to 1.5 m2
- Wood boards from 3 to 10 cm wide (enough to frame the surface)
- Wood nails
- A flexible plastic sheet larger than the surface
- Pre-washed sand (enough to cover the surface with a 2 cm layer)
- A sheet of geo-textile for paving stones to cover the surface (optional and available in garden centers specialized in installing paving stones)

Equipment

- Level
- Saw
- Hammer
- Stapler
- Drill and ⅛ in. drill bit
- Measuring tape

1. Adjust the level of the surface that will be used as a seedling table by placing small wooden blocks under the legs. If the ground is not level, water will not be equally distributed.
2. Measure a square that is 1 to 1.5 m^2 on the surface.
3. Cut pieces of wood according to the desired dimensions and nail them together to form a frame. Put the frame on the surface.



Seedling table with water reservoir.

4. Line the frame with the plastic sheet, making sure that the bottom of the seedling table and the four interior sides of the frame are covered in plastic.
5. If you have a sheet of geo-textile, put it on top of the plastic sheet. The geo-textile will improve water circulation, but it is not necessary.
6. Spread 2 cm of pre-washed, moistened sand on the surface of the seedling table.
7. Staple the plastic to the frame.
8. Drill a ⅛ in. hole in the center of the bucket's lid.
9. Fill the bucket with water and close it so that it is air tight.
10. Turn the bucket upside down in the middle of the table and bury a small part of it in the sand to reduce the movement of air to the hole in the lid.
11. Check the pots and seed flats. For the best results, the growing mix should almost be coming out of the drainage holes.
12. Press the bottom of the pots and seed flats into the first millimeters of sand to guarantee contact between the table sand and the seedlings' growing mix via the drainage holes.
13. Fill bucket as needed. If the pots, seed flats or table sand ever dry out because you forget to fill the bucket, water them abundantly to reactivate circulation of water from the reservoir.

Miniature Seedling Table with Reservoir

If you plan on preparing less than 14 seedlings in 4 in. pots, you can build a miniature seedling table to the scale of one seed flat. Just get a plastic flat **without drainage holes** and spread a 2 in. layer of sand in it. A 2 to 4 L glass container with a perforated lid will be used as a reservoir.

Finally, after all those hours of gardening come the rewards.
Enjoy your snack and here's to your edible rooftop garden!

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Ordre des ingénieurs du Québec (OIQ), **www.oiq.qc.ca**

ANNEX A

Descriptions of Our Garden Projects

Santropol Roulant Garden, Montreal

Address: 4750, rue Henri-Julien (Plateau Mont-Royal), Montreal (2004 to 2006) and 805 Sherbrooke West, McGill University campus (2007 to present)
Owner/Partner: Université du Québec (2004 to 2006) and McGill University (2007 to present)
Surface Area: 900 m2
Type of Garden: Institutional/demonstration
Inauguration: 2004

This large vegetable garden has been the main demonstration garden for the project since 2004. It is intimately linked to the Santropol Roulant activities, a meals-on-wheels program in the Plateau Mont-Royal borough. All food production is used to supply the meal-on-wheels kitchen. Managed by a team member, it is maintained by a socially engaged volunteer community that comes to garden in small groups at set times, three times per week. A site for food production and edible rooftop gardening experimentation, it is also a place used for project promotion and public activities. Thanks to the garden's size and visibility, we can hold large events there. This luxuriant, productive green space attracts many visitors and inquisitive people.

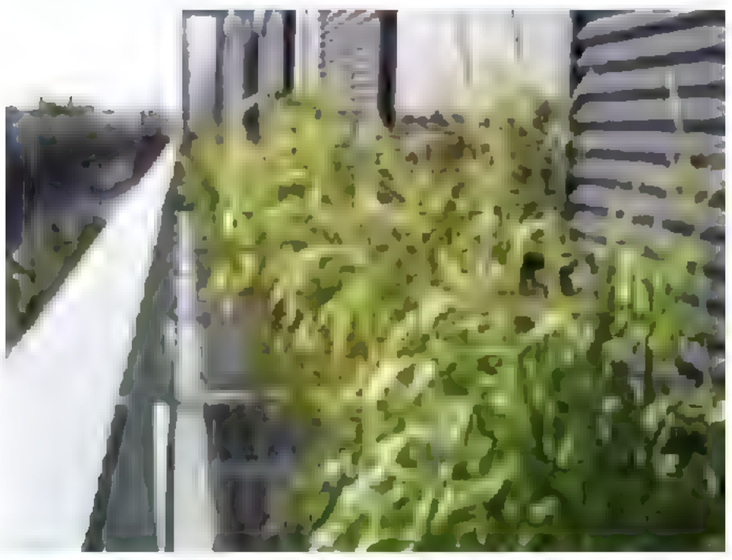
For more details, see "The Roulant Garden Experience", Annex B.

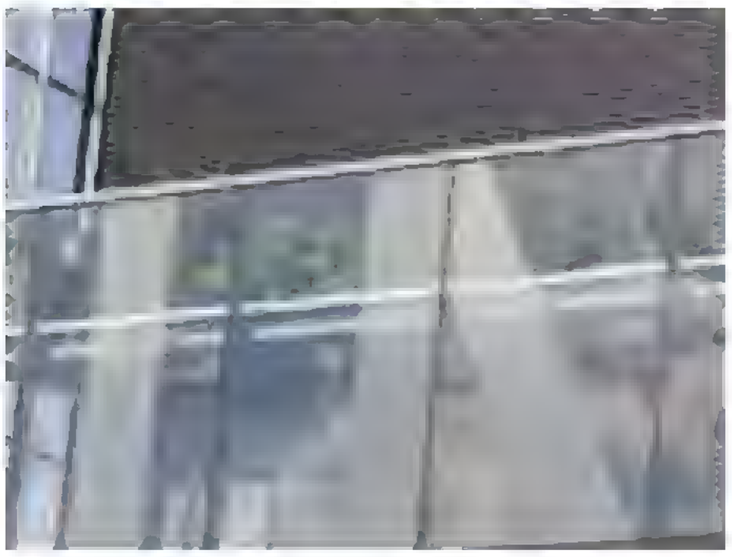
Jardin le Prévost, Montreal

Address: 7355, rue Christophe-Colomb (Villeray), Montreal
Owner/Partner: Ville de Montréal, rented by Patro le Prévost (community and recreational center)
Surface Area: 75 m2
Type of Garden: Institutional/demonstration/educational/collective

This linear garden has been set up on the terrace at the Patro le Prévost, a community and recreational center situated in the underprivileged Villeray neighborhood in Montreal.

The garden has transformed a previously unused space. Visible from the library and accessible to the numerous visitors that come to the center, the garden is cared for by volunteers. It is part of the collective gardens of Villeray at the Maison de quartier Villeray (which is responsible for food security projects in the neighborhood) and activities at the Patro le Prévost. Both a collective garden and an activity area for day camps, the site provides fresh vegetables to a meals-on-wheels program and offers stimulating and educational activities for the neighborhood's young people. As an addition to the traditional collective gardens, container gardens have great potential to inspire participants who would like to raise vegetables at home.





Jardin les Pénates, Quebec

Address: Limoilou, Ville de Québec
Owner/partner: Coopérative d'habitation les Pénates
Surface Area: 50 m2
Type of Garden: Collective/cooperative

This garden is a model for the self-managed, residential rooftop garden. Easily accessible by way of an outdoor staircase, it is also the ideal demonstration garden for Quebec City. The garden has proven to be a complete success by becoming a site of experimentation and discovery for participants with no concrete gardening experience prior to the project. The experiment was to see how a group of residents active in their social setting would organize themselves and ensure the garden's upkeep. Many children also participate in activities on the roof. A community composting project is in the works.

Jardin de l'ITHQ

Address: 3535, rue Saint-Denis, Montreal
Owner/Partner: Institut de tourisme et d'hôtellerie du Québec (ITHQ)
Surface Area: 80 m2
Type of Garden: Educational/Production

This garden is an educational tool for adolescents that participate in cooking day camps at the ITHQ. In addition to cooking workshops offered by the Institut, this immense balcony garden, visible from the street, is visited by chefs and young people to discover vegetables as they grow. An educational game teaches the youth about agro-industrial and ecological issues related in food production. In this junk food era, reuniting cooking and gardening is an excellent starting point for children to develop healthy life habits in a fun and pleasant manner.

Harvests are donated to Santropol Roulant's meals-on-wheels program.

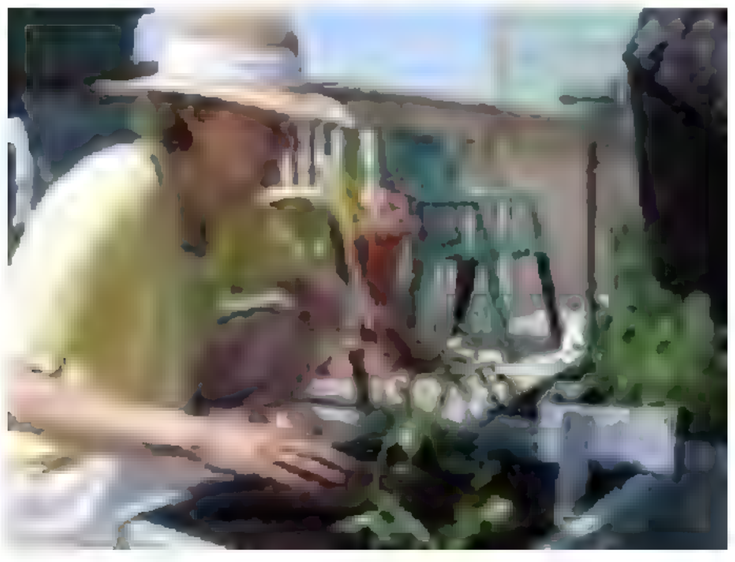
Golden Age Gardens

Jardin de la Maison Lizette-Gervais / Jardin des Habitations Les Boulevards
Address: Outremont/Montreal-North, Montreal
Owner/Partner: Residents, CLSC Montréal-Nord, gardening committees
Type of Garden: Recreational

Golden age gardens give elderly residents the chance to get involved and be active in a community by participating in a collective activity that brings about social cohesion, a sense of belonging to a project and to a group as well as the feeling of being useful.

The production of fresh and organic fruits and vegetables is also at the heart of the program. For some residents, it's a way to "get back to the land" and the opportunity to share and transmit their agricultural knowledge to younger generations. Gardening also provides physical benefits as it is good exercise in itself. Finally, seniors take pleasure in gardening outdoors with the community and participating in a project focused on cultivating plants, adding life to the residence.

Gardens set up in residences or institutions for seniors encourage solidarity and respect. They are mostly self-managed by participants. The Rooftop Garden team makes a few visits during the season to offer technical assistance and help organize the work. Putting the garden in place and work that is too physically strenuous is done by the project team or by younger volunteers.



ANNEX B

The Santropol Roulant Garden Experience

Lending a Helping Hand and Developing a Green Thumb!

The Santropol Roulant Garden took root on the roof of a Université du Québec building in 2004. In 2007 it was moved to the centre of McGill University's downtown campus. Covering 900 m2, the garden produces around 40 species of organic vegetables, fruits, herbs and edible flowers that contribute directly to the preparation of meals in Santropol Roulant's meals-on-wheels program. The community of young and bilingual gardeners is made up of approximately 100 volunteers that come in small groups to give their time to the planning and upkeep of the garden during supervised gardening sessions.

Born out of the collaboration between Alternatives and Santropol Roulant, the garden is part of the mission of both organizations. On one hand, this demonstration garden in the Rooftop Gardens Project (under the direction of Alternatives) network gives urban citizens the chance to help make their neighborhoods green and to discover an urban rooftop gardening project. On another hand, it is part of the Santropol Roulant food cycle: harvests supply the meals-on-wheels kitchen with fresh, organic vegetables, and the garden is part of the organization's social change mission (www.santropolroulant.org). In both cases, the development of healthy, socially engaged communities is at the heart of the initiative.

To develop and maintain the garden's dynamic community, we put our trust in group work that shares ideas, transfers knowledge and, above all, makes gardening a simple source of enjoyment. One of our concerns is giving our volunteer gardeners a rich experience that enhances their sense of self-worth. Therefore, the garden brings several interests together: going green and fostering nature in the city, being part of an urban agriculture and food security movement, developing social networks, getting involved in the meals-on-wheels program and participating in a stimulating outdoor activity.

This multifaceted mission enables us to approach gardening like a living laboratory: a place for discovery, meetings, learning and social change.

A Year, a Week and a Day in the Roulant Garden

To inspire you, here is an overview of how we work with our volunteer gardeners and how we organize our time over the course of a year, a summer week and a gardening session.

What does a year in the garden look like?

January/February

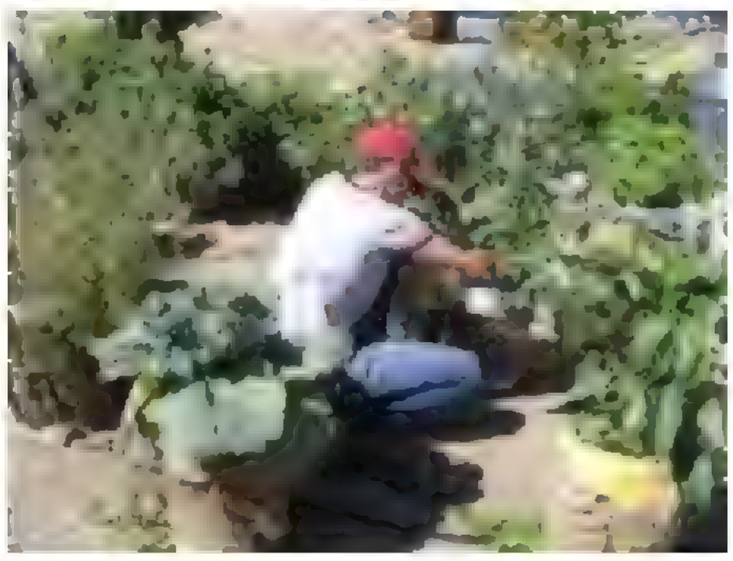
- Planning for the upcoming season with the coordination team: drawing up of the calendar and reestablishing contact with our partners.
- Drafting of funding requests.
- Exploring new possibilities for rooftop gardening.

March/April

- Information session to kick off the new season, mobilize the community and recruit new gardeners.
- Home vermicomposting workshops for volunteers who are interested.
- Community planning charrettes: collective planning session for the season.
- A community planning charrette is a dynamic work space where everyone is welcome to get involved; they consist of brainstorming discussions and small work groups on different themes (garden design, scheduling workshops and events on the calendar, organizing gardening sessions).
- Beginning of seedling room work (in a room reserved for this purpose at the Santropol Roulant) and involvement of volunteers in the activity (invitation by email). Gardeners will take care of seedlings with the garden coordinator until they are transplanted on the roof in June. Educational workshops and work are organized as well.

May/June

- Garden launch and regular gardening sessions that will last until the end of September (preparation of growers and substrate, planting, garden design, plant upkeep, etc.).
- Training sessions for new gardeners based on a structure of flexible involvement – offered every two weeks over the summer (see the inset: A Structure of Inclusive and Flexible Involvement).
- Party for the opening of the garden: Garden Party for the summer solstice.
- A happy hour to celebrate the arrival of summer and the beginning of the season of abundance. A moment to get new gardeners, returning gardeners, friends of the project and partners together in the festive setting.



July/August

- Continuation of gardening sessions: plant upkeep, fertilization, disease management and harvest.
- Workshops and special activities.
- From July on, several workshops take place on Thursday evenings during the gardening sessions: plant needs and health, gathering and preparing seeds, medicinal plants, From the garden to the plate culinary workshops in collaboration with the Santropol Roulant kitchen, creation of lanterns and ceramic objects, film showings, family picnics, discussion evenings, etc. These workshops are led by one of the project coordinators or by a guest volunteer.
- Annual BBQ.
- A big summer party to enjoy socializing with the community in a unique location in the city: a rooftop garden. This is the time to do some fundraising for the meals-on-wheels program.

September/October

- Harvest Party
  A community banquet to celebrate the fall harvest. This large collective food festival includes activities and music and is an occasion to present and welcome sponsors.
- Closing the garden for the season.

November/December

- Season review
  Winter activities to maintain the year's energy around the project: happy hour, thank you evening for volunteers, discussion evenings.
- Other volunteering possibilities for gardeners - at the meals-on-wheels program or at Alternatives.

A Structure of Inclusive and Flexible Involvement!

- Training volunteers is based more on the project's goals and dreams than on technique.
- Everyone is invited to participate in gardening sessions, at any time.
- No advance sign up is necessary, and there is no maximum number of volunteers per session. Gardeners simply come directly to the garden at the planned times (average per session for 2006: 10 gardeners).
- No gardening experience is necessary.
- Formulas are filled out by volunteers: contact information, references, emergency contact numbers, email for the mailing list, optional section (interests, main occupation, link to the project).
- New people who are interested or those that come directly to the rooftop can start participating in sessions from the moment they arrive and go through the training in the following weeks.

The goal of this malleable structure is to seize the favorable moment and to get people involved as soon as they are interested in the project. Though this structure can sometimes generate chaotic situations or ones that are more difficult to coordinate, it is very much appreciated within the community.

What happens during a week in summer at the rooftop garden?

- Three collective gardening sessions are organized per week: Tuesday from 9:30 a.m. to 12:30 p.m., Thursday from 4:00 p.m. to 7:00 p.m. and Saturday from 9:30 a.m. to 12:30 p.m.
  These gardening times were chosen to respond to regular needs of the garden (care within 48 to 72 hours), above all

watering and harvesting. In addition, afternoons on the roof are very hot and, therefore, not very good for gardening, as much for the gardeners as for the plants. Sessions take place in the morning or in the late afternoon. This time slot also enables volunteers to benefit from a variety of gardening times and days, which can accommodate the work hours and occupations of many of our gardeners.

- Wednesday morning: team coordination meeting (review of the week and planning for the following week).
- Wednesday evening: yoga (lead by an organization specialized in yoga).
- Every other Thursday: gardening session followed by a workshop or special event.
- Saturday afternoon: weekly, bilingual email Weekly Garden News and update of Internet site (www.rooftopgardens.ca). We keep an up-to-date mailing list of gardeners and friends of the garden. In addition to gardening sessions, emails and the Internet site are special means of communication for sharing information with the entire community.

What happens during a typical gardening session on the rooftop garden?

3:30 p.m.: Gardening coordinator arrives

Survey of the garden and preparation for the session: look at the tasks to be done in the log and the tasks to carry out in order to respond to the immediate needs of the garden. Write down the tasks for the day on the black board set up in the garden. When possible, two coordinators participate in the sessions.

4:00 p.m. to 5:30 p.m.: Gardening and vegetable delivery

Arrival of first gardeners, welcome and beginning of work. Very often, watering must be done first. Tasks are carried out with pleasure and according to the rhythm of each gardener: some are very active while others are laid back. In parallel to the watering, harvesting starts. Once the harvest has been completed and weighed, two volunteers leave on bike, their backpacks full, to deliver vegetables to the meal-on-wheels kitchen. During this time, gardeners take time to identify insects and diseases, to weed, to fertilize, to transplant or to do other activities (i.e. the construction of a pergola).

5:30 p.m. to 6:00 p.m. Clean up and Collective Discussion

Approximately ten minutes are set aside for cleaning tools and equipment. Afterward, the group gathers together for a improvised tasting of vegetables from the garden so that each gardener can explain the tasks they carried out and share what they learned (educational aspect). The group then lists the tasks and activities that could not be completed and those that must be done during the next session to respond to needs observed in the garden. This is also a time for creativity and proposing new ideas. Everything is written down in the log book.

Some tools designed with gardeners and used during the gardening sessions

The Log

This is a journal where an archive of what happened at each gardening session is kept. One page is reserved for each session. It includes a header where the date, the number of gardeners and visitors, the temperature, the coordinator's name and the rainwater measurement are written. There is a space to note tasks and observations, and a watering map on the back.

The Watering Map

This creative map of the garden is divided into different neighborhoods in Montreal, with the cardinal directions. The map is used to guide gardeners spatially and enables the coordinator to make sure that the entire garden has been watered at the end of the session. The gardeners check off different neighborhoods as they water plants in each section.

The Daily Task Board

A black board set up in the garden is used to write down the tasks to be accomplished at the beginning of each session. Gardeners greatly appreciate the fact that it is highly visible.

Our Key Concepts

Inclusive and flexible structure of involvement

Collective planning of the season and daily tasks: emphasis on creativity and ideas

Lots of communication

Living Lab approach: a place for discovery, experimenting, meeting people and learning

The garden's rich and innovative mission

6:00 p.m. to 7:00 p.m.: Horticultural or Artistic Workshop

A coordinator leads a thematic workshop (e.g. nutritional deficiencies, diseases and pests) or a guest leads an artistic workshop (e.g. ceramics). Often, at the end of the session, part of the group goes to a local coffee shop to continue the conversation and sometimes to imagine a better world.

We believe that doing things in these ways, which are guided and structured yet chaotic and organic at the same time, is what makes the participation of over 100 gardeners a success each season. Thank you to the community for your energy and enthusiasm!

ANNEX C

Pamphlet on the Rooftop Gardens and Green Roofs

Green Roofs & Rooftop Gardens

solutions for a greener & healthier Montreal

By growing plants on Montreal's rooftops we can improve our air quality, save energy and enjoy new green spaces in our crowded neighbourhoods.

Green roofs and rooftop gardens offer many environmental and financial benefits. Whether you are a building owner or renter, we can help you to green your rooftop!

Green roofs that involve the cultivation of grasses, shrubs, and low-growing plants offer the greatest environmental benefits for the minimum cost and maintenance required.

Rooftop gardens are places where people can enjoy growing ornamental or edible plants. Using rooftops and balconies as new urban green spaces expands opportunities for growing healthy food and recreational spaces for city dwellers.

Green roofs and rooftop gardens improve our urban environment by:

- reducing cooling/heating energy requirements within the host building
- diverting rainwater runoff before it reaches our over-stressed municipal sewers
- improving urban air quality
- mitigating the urban heat island effect, that can render a city 5-10°C hotter than its surroundings

What are your options?

Green roofs can be integrated into new building designs or retrofitted on older roofs. Green roofs are constructed with special membranes that are proven to protect the roof structure from leaks, and are designed to have a shallow soil covering in which plants grow. The additional costs of building a green roof can often be recovered through energy savings and the prolonged life of the roofing material due to the additional insulation provided by the vegetative covering.

Rooftop gardens can be built onto the roofing structure using special membranes. Ultra-lightweight soilless container gardens can often be installed on existing rooftops, rooftop terraces, and balconies without requiring structural reinforcement. Small-scale rooftop gardens require safe and simple access for gardeners to maintain the plants.

If you are considering installing your own green roof or rooftop garden, first consult a roofing expert to check your structure.

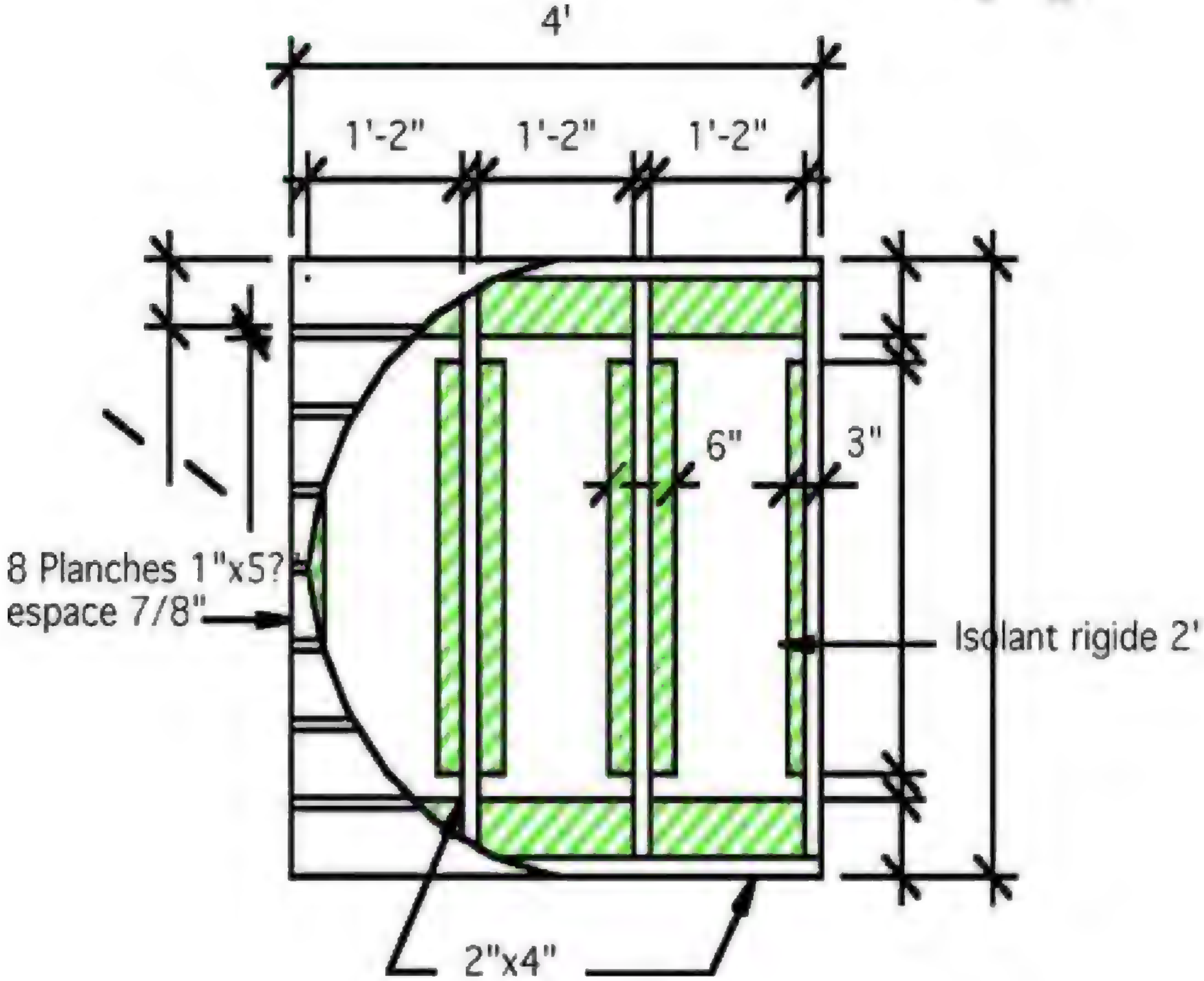
For more information or to visit green roofs and rooftop gardens in the Montreal area, please contact:

The Rooftop Garden Project
www.rooftopgardens.ca
Tel: (514) 286-9515

Centre d'écologie urbaine
www.urbanecology.ca
Tel: (514) 282-8200

ANNEX D

Moveable Panel Model



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C'est la Vie!

Ismaël Hautecœur jardine entre ciel et terre dans le cas sans le haut des verdure à Hugo et de l'horizon.

Le popote intergénérationnelle du Santropol Roulant.

Cultivés et bien élevés

Une popote roulante prend racine sur les toits

Josée Blanchette

L'espoir, c'est vert. L'espoir pour une planète plus saine, pour les jeunes en herbe, pour les vieux qui végètent, même pour Haïti qui crouple. Ces jeunes-là savaient pu se contenter de faire pousser du pot bio sur leur balcon et se raller de leurs légumes. Ils cultivent plutôt trois variétés de tomates et de sauge, de la camomille et de la lavande, sur le toit d'un édifice de l'UQAM. Ils font aussi leur compost et de la ratatouille qu'ils servent à des vieillards en perte d'autonomie et en quête de contacts humains.

Si jamais je devenais suicidaire, anorexique ou dépressive, and quelque chose ou dropout de rien du tout, si je ne sais plus dans quel sens me tourner les pouces, c'est au Roulant que j'irai donner le temps qu'il me reste. Quelques heures par semaine à me vivre dans leurs cuisines avec Catherine, 24 ans, qui a étudié à l'Institut de tourisme et d'hôtellerie du Québec et suivi un cours en anthropologie sociale du vieillissement, à faire des livraisons à pied ou à vélo avec Richard, un jeune ex-boulanger, à jardiner sur un toit en écoutant le vent gémir, me ferait reprendre contact avec le sens d'un coup de pouce, la communauté, l'échange et l'héritage.

Le Santropol Roulant, qui organisme sans but lucratif qui tente de briser l'isolement et de favoriser un rapprochement intergénérationnel — un mot cher à Bernard Landry —, a eu la bonne idée de lancer le projet «Des jardins sur les toits» cet été. En collaboration avec Alternatives, un autre organisme qui soutient des projets communautaires tant au Nord qu'au Sud, une quarantaine de bénévoles ont participé à cultiver de la laitue et des fleurs comestibles, un basilic et un mangeoire donnés par le Jardin botanique de Montréal, entre ciel et terre.

Ils ont survécu fait la preuve que la pénurie de toits et que les toits de Montréal peuvent facilement devenir des bulles de vie communautaire, des espaces verts et des gardes-manger.

Basilic hydroponique

Ismaël Hautecœur, le pouce vert et l'architecte-paysagiste du projet, est également titulaire d'un bac en philosophie et on manque pas de mots pour expliquer ce projet qui s'inscrit dans la tendance de l'architecture verte. «C'est une culture dans un substrat (sans terre) qui demande le moins d'eau possible pour pouvoir être appliquée dans le Sud (Cuba, Sénégal, Haïti, par exemple). On recrée un écosystème artificiel avec des fleurs comestibles pour attirer les insectes pollinisateurs, des tournesols pour les oiseaux, on recycle l'eau de pluie et on cherche un équilibre sur le toit», explique Ismaël, 31 ans.

Cette ferme d'agriculture «légère», dans des bacs de plastique, demande peu d'entretien, aucun désherbage, et peut aisément s'appliquer dans le contexte de la Palestine, où la population éprouve des difficultés d'approvisionnement, qu'à Montréal, où elle ajoute à la qualité de vie des habitants. «Montréal est une ville horizontale, constate Ismaël. Toutes les générations jardinent. On s'intéresse aux produits bio, du terroir, à la gastronomie, on simple fait de partager son bon repas. Et de plus en plus de gens aménagent le toit de leurs maisons comme».

Encouragés par les résultats et stimulés par l'échange, plusieurs bénévoles ont reproduit des jardins sur leur toit ou leur balcon cet été. Au lieu de pavoiser 3000 bâtiments aussi d'arriver dans leur assiette, une courgette n'aura eu que quelques marches d'escalier à franchir. «Pour nous, ce projet permet d'offrir aux clients des choses qui coûteraient trop cher, comme des fleurs comestibles. Mais on y trouve toute une valeur non monnayable», estime Jean Rabinowicz, 23 ans, employée du Roulant depuis trois ans et responsable des bénévoles pour le jardin. Cette valeur, pour les bénévoles, se traduit de plusieurs façons: liberté d'expression, qualité d'écoute, sentiment d'appartenance, soutien aux études, qualité des rapports humains, construction d'un réseau, revitalisation de ses valeurs et apprentissages multiples.

Si l'antipsychologie vous intéresse

«L'environnement, c'est une cause déprimante, sans le faire. C'est là qu'on s'est placés collectivement. Moi, je me fous du débat, je travaille à petite échelle pour promouvoir un système de vie sain dans la ville, je prêche par l'exemple et j'y crois.» – Mêmes soin de cloche pour Ismaël, qui cultive sa rose comme le Petit Prince: «C'est à travers l'éducation que les gens vont être mieux nous. J'ai beaucoup d'espoir en l'enfance pour cette raison.» On pourrait toujours rêver que les toits des écoles du Québec soient métamorphosés en jardins communautaires. Why not, comme? S'ils n'ont pas de livres dans leurs bibliothèques, ils pourraient avoir des navets qui poussent sur le toit.

J'ai demandé à Ismaël et à Jean s'ils ne s'embêtaient pas la tête dans leurs plants de basilic thaïlan dois alors que plusieurs scientifiques et environnementalistes ne donnent plus bien cher de la planète. Le mal est fait. «Tu ne feras pas naître avec l'optimisme "Si tu dis monde sera bien dans 50 ans". Le fin du pétrole dans 60 ans, c'est plus probable», pense Ismaël, qui philosophe: «Le jardinage a une fonction thérapeutique, nous reconnecte sur les saisons et sur cette chose qu'une économie productiviste. Produire un sac de légumes par semaine, ce n'est rien, mais le fait d'être transformé par une activité saine, ça, j'y crois. Ce par mot à l'individu de renouer avec un sens. Les médias, la politique s'adressent au cerveau. C'est pas étonnant qu'il y ait autant de problèmes de santé mentale. Avec le jardinage sur les toits, on sort de notre tête, on revient à une activité de base à l'ère de la réalité virtuelle. On se reconnecte à nos sens, on se fait du bien et sur les autres, on agit sur l'esprit par le corps au lieu d'agir sur le comportement par le discours. En fait, c'est la forme la plus simple d'autothérapie. C'est de l'antipsychologie. Ça change les idées et c'est une invitation de voir du bon côté en accédant à la lumière, à la place, on sent.»

Au-dessus de nos têtes, l'horizon s'offre à nous. Ça fait pas chier le bleu pour voir plus loin que le bout de son nez.

Le Santropol Roulant en chiffres

■ 2e100 heures de bénévolat par année; 200 activités intergénérationnelles; 150 bénévoles; 140 clients; 100 périodes de travail hebdomadaire; 30 menus différents personnalisés selon les goûts et les allergies des clients; 10 employés; 9 années d'existence; 8 quartiers desservis; 6 jours par semaine; 3,50 $ le repas; 1 atelier «Vélo» ouvert à tous les bénévoles pour apprendre à réparer leur vélo; 1 site Internet, www.santropolroulant.org, où on explique la démarche des jardins sur les toits.

Envoyez vos commentaires à cbeaudet@ledevoir.com

The Gazette, newspaper, October 2005

Rooftop gardens bear fruit

Groups seek to refine Montreal's landscape

MICHELLE LALONDE
THE GAZETTE

Stand on any flat rooftop in the densely populated neighbourhoods of Montreal and you will be struck by two things.

First, Montreal is chock-a-block full of rooftops.

Second, from this vantage point, even our crowded, cookie-cutter neighbourhoods are delightfully spacious and peaceful. Aside from a few wooden terraces, you'll see nothing but hundreds of flat, gravel-covered rooftops. A megawide wasteland.

Now imagine this grey wasteland transformed into a green patchwork quilt of rooftop gardens. Imagine plants and bushes yielding vegetables, fruits, herbs, berries and herbal medicines for the residents below.

Imagine tube-shaped planters lush with greenery and edible flowers wending around Montreal's trademark spiral staircases.

Please see ROOFTOP, Page A3

Rooftop | The edible landscape

CONTINUED FROM A1

Imagine all those empty rooftops harvesting tomatoes, basil, peppers and lettuce. It's called "urban agriculture" and it is by no means new as a concept — what is new is a movement to make rooftop gardening a widespread reality in Montreal.

For the past four years, two local non-profit organizations have been experimenting with a new set of rooftop gardening. The aim is to make rooftop or balcony gardening easy, cheap and available to your average Montrealer.

Alternatives, a group that sets up solar panels, and Concordia Students, a student-run service, have established several rooftop gardens, which yield fresh produce for cash-strapped Montreal's annual poor list.

"What we are trying to do is [not go] digging in the urban soil," said Alex Hill, an environmental engineer who coordinates the Rooftop Gardens Project.

"Maybe in the future they will opt at the first that our grandchildren will say we were [crowded] in one to three gardens, when we all this natural space on our offices. Maybe it will be as normal to have a rooftop garden as it is to have an indoor toilet now."

That's a plausible scenario, according to McGill University's Alissa Short, author of Making a Edible Landscape. A study of Your Agriculture in Montreal.

"I think it will be the next big step," he said.

In his book, Short remembers a Urban Wasteland Project in the early 1970s. A group of members calling themselves a Montreal Cool Planting Group planted a huge garden on 1,400 square metres' rooftop in a McGill plaster. The book notes Montreal's remarkable track of community gardens, one sought after plots in central, mostly unused land throughout the city where about 50 urban gardeners every year create Montreal's community garden park — is the largest of its kind in North America.

And local businesses like Montreal Equipment Group's survival outlet are leading the way in modifying the advantages of "green roofs," rooftops covered with equipment with a special membrane and a layer of soil in and grasses in. This provides real insulation, saves on heating and cooling costs and reduces air pollution and green-house gas effects.

While both the Urban Wasteland Project and green roofs are groundbreaking initiatives, they are both expensive options that have not been widely related. Because of the sheer weight of water-logged soil on rooftops, especially in winter, both required expensive reinforcements to avoid damaging the roof's structure.

Santropol and Alternatives, on the other hand, are pushing a new form of rooftop gardening that is inexpensive, lightweight and has a higher yield compared with traditional gardening. They market other many of the foundation advantages of green roofs, plus the delights of harvesting real food. They have been developing workshops, start-up kits and instruction manuals, and handling them out at low cost to encourage them to set up their own rooftop or balcony gardens.

This spring, the project sold all of its 50 start-up kits at $30 a pop, to new-to-be rooftop gardeners. Most said they hope to sell 100.

The demonstration garden on the roof of a Université du Québec building at the corner of Villeneuve and Henri Julien St. in the Plateau is actually a collection of various types of container. These portable containers hold the plants in place, many can be kept warm and very little soil or substrate.

This fall, the garden's meager harvest included four varieties of tomatoes, ground cherries, peppers, cucumbers, cucumbers, squash, basil, swiss chard, parsley, lemon thyme, strawberries, red cabbage, rhubarb, Jerusalem artichokes, sunflowers, climbing beans, as well as several types of edible flowers. There were also a number of exotic vine and stalk fungal plants, to ward off pests and other problems.

Since the bulk of what the containers hold is water, after the harvest, the gardeners only have to dump the water, save the substrate for re-use and store the containers for the winter. Because the containers are light and easily movable, the technique is attractive to seniors and homeowners alike.

The typical container — and Hill and company are experimenting with many variations — is a plastic Rubbermaid-style storage bin, with several round holes cut in the lid to fit plastic flower pots. The pots have holes punched in the base so that the roots of the plants can grow through. A porous wick leads these roots to the water next to water below in the bin.

Although the garden borrows hydroponic technologies, Hill prefers to call it "soil free" gardening. It is a much simplified version of hydroponics, in that it doesn't require a complicated system of pumps to aerate the water and get it to the plants because the plants are suspended over water, with first the wick and then their roots trailing down into the pool below. The roots get oxygen from the air.

The system uses about one-tenth of the water used in regular gardening, where much water is lost through evaporation or sprinkle drains through the dirt to the water table. Because the water sits in the container, the plants don't need to be watered every day. The water needs to be replenished only every couple of weeks. The steady water supply and careful control of nutrients present in each section means that the plants are about four times as productive as those grown in soil.

"When people have a hands-on experience with agriculture, they naturally gravitate toward more nutritious food"
Alex Hill, Rooftop Garden Project

The team also is experimenting with pipe-like containers that run vertical down spiral staircases, and more aesthetically pleasing containers for residents who see their roofs and balconies as extensions of their homes, and as spaces for entertaining guests.

Each wood Montreal roofs are designed to hold about 30 to 40 pounds per square foot in order to weather heavy snowfalls, they can certainly support those lightweight containers of water and plants in summer months.

Apartment buildings are not usually designed with some sort of roof access, although managers may have to negotiate with local tenants' associations and safety inspectors. Most homeowners with rooftop gardening dreams would have to answer to no one but their conscience or city bylaws.

Still, Hill notes, it's cheaper than transforming a roof for conventional gardening, and less trouble than moving to the country if what you are really craving is just a relaxing, lifestyle-enhancing garden.

Hill sees a future where a network of the kits his team is developing will be more produced and sold in hardware stores. The overall promotion of start-up gardens is also a key part of the project. Hill envisions a plastic shopping bag full of seeds, soil and instructions for growing a garden in a bag.

Apart from the sheer enjoyment of fresh, homegrown produce, Hill says it's important for city folk to get reconnected to where their food comes from.

"It gets to the heart of what is not sustainable in our cities, and one thing that is certainly not sustainable is driving our food to and out of the country across long distances all year round. When people have a hands-on experience with agriculture, when their families and children get involved in gardening, they naturally gravitate towards more nutritious food. There is a high degree of personal satisfaction with connecting to the ecological cycles."

Hill says city gardening is also about "food security."

In times of crisis, whether it be economic, military or natural, people need to know how to grow their own food. "You could be home, in your own city, at least one in every 20 people who can distinguish how to produce food. You have to be prepared."

Edible Landscape author Alissa Short remembers the Santropol. After serious initiation as a natural evolution from what his team was doing with its rooftop garden project in the 1970s. He has studied urban agriculture in developing countries, where it is done for sustenance and income, and not just pleasure, and notes that the movement is gaining popularity all over the world.

"I'm not saying everybody can be self-sufficient, but we can reduce our consumption patterns, which are so immensely energy-based. In our climate we can't grow our own food, but we can do an awful lot more than we are doing."

For more information on the Rooftop Garden Project, go to www.alternatives.ca or www.santropol.ulaval.org

BEN GARRATON, THE GAZETTE
Benjamin Cosgrove (right) shows Ali Shah (left) and Faraz Mallal one of the "soil-free" systems on the roof of the Université du Québec building at the corner of Villeneuve and Henri Julien St.

Bio-bulle, magazine, October 2006

ROMÉO BOUCHARD : COMMENT ASSURER L'AVENIR DES RÉGIONS ?
Bio-bulle
ma toiture en culture
deux villes, deux organismes, deux projets
tout savoir sur les engrais verts
bonnes pelures à manger !

Dossier

Des Jardins sur les toits
Le social et l'environnemental

Utiliser l'espace vacant de nos toits pour cultiver des potagers, des champs de fleurs et un verger à l'effet de serre... Une idée révolutionnaire ou un retour aux sources?

Pour donner l'exemple, du jardin Samuel-Lemaire, l'un de ceux ayant vu le jour à l'hôtel de ville...

Photo : Anne Ermenault

Retenir d'eau, oranges, laitues, aubergines, zucchinis, tomates, fraises, basilic, romarin. À gauche, les expérimentations; à droite, la zone de production. Plus de terre couvrant la surface du toit, uniquement des contenants de plastique et des récipients récupérés remplis de terreau. Un banc à rempoter dans un coin et des boîtes à fleurs à l'entrée, nous sommes sur le toit de l'Hôtel un pavillon de l'Université du Québec à Montréal. Trois fois par semaine, entre 5 et 25 bénévoles se rassemblent ici pour arroser, transplanter, récolter et désapprouver les pleurs. Ils ne repartiront pas avec les légumes. La récolte est entièrement acheminée à Dominique Perchaud, qui elle animera dans la composition de repas saisonniers et distribués à des gens dans le besoin.

PAR STÉPHANIE GROLEAU

« On ne va pas nourrir Montréal en régions, l'un des nombreux objectifs, en ses 37h, Hanna Gabriel, est d'être un lieu de démonstration et d'éducation afin de répandre l'idée d'agriculture urbaine », explique Annick, coordonnatrice des bénévoles. L'objectif de la culture en commercial est aussi l'autonomie, tout peut être rangé pour l'hiver. De plus, selon les experts, le toit est supportant par nécessairement la charge de terre requise pour le couvrir. Ainsi, cultiver en contenants permet à quiconque de les placer sur son balcon, sur sa rampe d'escalier, sur le rebord de la fenêtre, etc.

Les jardins sont collectifs. Chacun est libre de donner ses idées. Selon Annick, « le jardin est un prétexte pour regrouper les gens, pour les sensibiliser à l'alimentation et à la consommation responsable. Les gens viennent ici pour élever leurs un réseau social, comme c'est le cas pour les nouveaux arrivants. » Aux jours ensoleillés, des ateliers sont offerts, que ce soit la cuisine de fines herbes ou la fabrication de savons. En tant que lieu de vie, le jardin offre aussi des cours de yoga et de danse ainsi que des événements portes ouvertes comme un BBQ sur le toit. ●

Dossier

Cette idée de jardin vient d'Alternatives, un ONG de développement international. Il implique des projets développés dans le sud (Cuba, Sénégal). L'organisme désirait réaliser un projet semblable, mais localement. Il développe un partenariat avec l'organisme québécois Resilient et cherche à adapter les techniques au climat montréalais. L'objectif était aussi d'intégrer les jardins aux activités de Saint-Henri, explique Annick. « Nous la banlieue dimensions démunies, transplanté sur le toit, utilisé les ressources à la maison, puis composter les résidus avant de les ramener sur le toit. Nous en avons compris sur l'acte de 100 000 sacs de terre déplacé cinq gallons de résidus de cuisine par jour.

L'équipe du jardin se compose de quatre permanents et de cinq coordonnateurs. Ensemble, ils assurent le suivi des plants et des bénévoles. Samuel Haudenosaur, responsable du projet chez Alternatives, précise que l'équipe travaille pour le grand public. « Tout le monde ne peut pas se permettre un toit de 40 000$, surtout que bien des gens n'ont accès qu'à un balcon. Alors, comparativement à la construction d'un toit végétalisé, la culture en bacs revient bien moins cher. Notre « Boîte, sortie de contenants,

ces nouveaux sont livrés aux particuliers de une surface de culture

sont vitrés : des sacs, des demi-tonnes, de plastique, et même des tuyaux de PVC pour les tuteurs. La culture en bacs permet aussi d'utiliser des engrais naturels et non cumulatifs contre les environnements, et même des semences dont le sol est contaminé.

INNOVATION ET INVASION

Jusqu'à maintenant, différents systèmes existent (les expérimentaux (hydroponique), semi-hydroponique, contenant de terre), mais le plus efficace fut le bac autoarrosant avec double fond et terreau. En effet, selon Samuel, « il faut donner le droit aux gens de commencer. Il ne faut pas les décourager dès leurs premières tentatives ratées. Avec la culture hydroponique, on peut tout mettre et remarquer mais c'est plus complexe et subtil ». D'autant plus que l'an

JUNGLE À QUÉBEC

Coopérative d'habitation nouvellement formée, Les Récoltes de tomates possède un jardin sur le toit depuis deux ans. Cette année, son cultivé principalement les bacs, car nous y requièrent moins d'eau et un minimum d'entretien, comparativement à l'hydroponique l'an dernier. Faisant un, sont deux fois par semaine, les récoltes sont dus gens qui s'occupent dans le projet. Auparavant, le personnel servait de bénévoles et d'animation, mais trop l'édifice achevé, le travail avec les architectes comme d'aménager 78 logements. Malheureusement, l'aide offerte par le programme des coopératives n'inclut pas le projet. Impossible l'implantation d'une toiture végétale. Mais selon Adrien Coutlée, vice-président, « il était temps voilà un membre puisque la majorité a été membre très des résidents. » Il est là, la culture en bacs est toute indiquée pour les débutants. Elle ne demande pas de connaissances particulières et les résultats sont rapides. Il suffit de suivre les instructions et d'avoir la main verte.

Adrien Coutlée : Il était temps qu'il y ait un membre du personnel

Certains jardins, l'équipe travaille dans une réunion d'information à la culture en bacs. Au coût de 40$, elle consiste en un bac fabriqué avec du plastique recyclé provenant des retailers de couches de plastique et de semences hybridées. Ce contenant s'utilise en plusieurs de fond supérieur et en remplissant les quatre cent avec de la fibre de noix de coco bien lavée. Cette fibre fait notamment à ses longs les terreaux par capillarité. Ensuite, le contenant est rempli d'un substrat de croissance composé de tuteur de pousse vertical et de terreau. Quelques fois par semaine, de l'eau était pour assurer grâce au petit tuyau traversant le terreau jusqu'au réservoir formé par le double fond. Pour tester l'accès d'eau, un petit trou sur le côté sert comme témoin.

UN PROJET QUI PORTE FRUIT

Démarré de manière expérimentale sur le toit d'un garage en 2002, ce projet laisse aujourd'hui place à un véritable réseau de jardins et est soutenu par divers organismes, autant communautaires que gouvernementaux. De

The Rooftop Garden Project

liberating spaces for healthy cities

The Rooftop Garden project is an innovative partnership between Alternatives and Montreal community organizations such as Santropol Roulant and the Maison de quartier Villeray. Together, we are working to make rooftop gardening a common practice in Montreal and around the world. Our gardens allow citizens to produce their own food, green their neighborhoods and build healthy communities.

If you would like to get involved in our gardens or obtain more information about the project and gardening, visit our website

www.rooftopgardens.ca

Alternatives
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Nourishing our Community

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